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DEFENSE INDUSTRY BULLETIN

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Suggestions from industry representatives concerning possible topics for future issues are welcome and should be forwarded to the Editor at the address shown below.

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PPBS in Defense for the Seventies

Laurence E. Olewine

Less than a year ago, the *Defense Industry Bulletin* published an article on the Defense Department's Planning-Programming-Budgeting System (PPBS). The final paragraph of this article stated, "A decision-making process cannot be set in concrete. It must remain dynamic and susceptible to change if it is to retain its utility."

This statement not only rings with truth, but is documented with the considerable modifications to DOD's current PPB operations. Significant changes in this vital facet of the DOD decision process provide the basis for a second article within a year.

(See article, "Defense PPBS—A 1969 Overview," by Commander Steven Lazarus, *Defense Industry Bulletin*, June 1969, page 19.)

Sometimes it is difficult to find specific evidence of change when a firm hangs out the UNDER NEW MANAGEMENT shingle. Such is certainly not the case in the Defense Department, where Secretary of Defense Melvin Laird and Deputy Secretary David Packard have made major revisions in the Planning-Programming-Budgeting System (PPBS).

To trace the evolution of these changes, we must go back to a Secretary of Defense Management Conference held in May 1969. This two-day meeting, attended by the Presidential appointees within the department, was aimed at improving DOD's top-level decision-making process. As a result of discussions at this meeting, basic principles were established for major revisions to the PPB System. A few months earlier, a Pentagon staff effort had also been launched to simplify PPBS procedures. The meshing of these actions resulted in a restyling of the Defense Department's PPB System. The modifications, accepted by all DOD components (military services and defense agencies), are reflected in an Oct. 29, 1969, revision to DOD Instruction 7045.7, "The Planning, Programming and Budgeting System," which is being used as the procedural basis for preparation of the FY 1972–76 defense program and the FY 1972 budget.

This article will not discuss details of the revised PPB System, but will focus on major changes. Emphasis will be on the four new documents that have been added to the cycle. It must be stated at the outset, however, that the Five Year Defense Program (FYDP) is still the heart of the Defense Department PPB System.

One of the key changes is provision for increased input from and consultation with the National Security Council (NSC). The relationship between the Defense Department PPB System and the NSC policy review process is much closer than it has been in recent years. Results of this relationship will be seen in a number of ways in the revised system.

For instance, after forwarding the Joint Strategic Objectives Plan, Volume I, (JSOP I), the strategy and objectives portion of this plan, to the Secretary of Defense, the Joint Chiefs of Staff (JCS) revised it in order to include full impact of the President's recent strategy decisions. These decisions were based on an NSC review of alternative worldwide strategies, forces and budgets. The final version of JSOP I (published in December 1969) provides a more valid basis for planning and programming than did previous JSOPs. There is no question that JSOP I will exert more influence than its recent predecessors.

Strategy Guidance Memorandum

The initial new document in the revised PPB System is based on a review of JSOP I by the Office of the Secretary of Defense. As a result of this review, the Secretary of Defense prepares a *tentative* Strategy Guidance Memorandum. This memorandum incorporates much of JSOP I, and reflects any modifications or additional strategy guidance deemed necessary by the Secretary of Defense.

The tentative Strategy Guidance Memorandum is then sent to the Joint Chiefs of Staff for review and comment. After considering JCS comments,[1] the Secretary of Defense issues a revised Strategy Guidance Memorandum to JCS, the military departments, and the defense agencies early in January. Since the memorandum and JSOP I provide the basis for force planning, the goal of the issuance is current and completely coordinated strategy guidance for the entire defense community.

Fiscal Guidance Memorandum

The second new document is the Fiscal Guidance Memorandum issued by the Secretary of Defense. The memorandum represents a major departure from the previous PPB System. The fiscal guidance indicates overall dollar constraints within which programs are to be developed. The Secretary of Defense issues *tentative* fiscal guidance in January for review and comment by the Joint Chiefs of Staff, military departments and defense agencies. The Fiscal Guidance Memorandum for FY 1972–76 was issued in March.

Based on anticipated DOD dollar resources, the Fiscal Guidance Memorandum projects allocation of funds five years into the future by major mission and support categories for each of the military departments and defense agencies. In preparing the fiscal guidance, consideration will be given to JSOP I, the Strategy Guidance Memorandum, and the current Five Year Defense Program.

To ensure a balanced DOD program, the FY 1972–76 Fiscal Guidance Memorandum indicates that both the Joint Force Memorandum and the Program Objective Memoranda (which are discussed later in this article) must contain a base program with funding levels matching those specified in the fiscal guidance, by military service and by year, for each of the following categories:

- Strategic Forces.
- General Purpose Forces (the *total* of land, tactical air, naval and mobility forces).
- Research and Development (FYDP Program 6).
- Intelligence and Security.
- Support to Other Nations.

To provide flexibility, DOD components may propose alternative force structures based on reallocations among the aforementioned categories by means of annexes to the Joint Force Memorandum and Program Objective Memoranda, as long as military service totals by year remain unchanged.

Introducing fiscal constraints near the beginning of the annual PPB cycle provides a basic change at the very roots of the system. Taking account of the limits on funds early in the cycle forces consideration of alternatives and priorities throughout the entire process by everyone concerned. The constraints of fiscal reality will generate more efficient analysis and evaluation at every step of the process.

During the period when tentative fiscal guidance is being reviewed by the military departments and defense agencies, the Joint Chiefs of Staff are completing JSOP II, the force structure portion (Volume II) of the Joint Strategic Objectives Plan. JSOP II provides recommendations, as well as the associated rationale, on forces needed to meet the strategy guidance. It is significant to note that as in previous PPB cycles, JSOP II is prepared without regard to specific financial constraints.

Joint Force Memorandum

Publication of JSOP II and the Secretary's Fiscal Guidance Memorandum in February and March, respectively, sets the stage for the third new document in the revised PPB System, the JCS Joint Force Memorandum.

This document, issued in April, is indicative of the revised role of the Joint Chiefs of Staff in the PPB cycle. The Joint Force Memorandum again presents force level and support program proposals in a format similar to JSOP II, but JCS recommendations will have been reworked to reflect fiscal constraints of the Fiscal Guidance Memorandum. Where funds delineated in the Fiscal Guidance Memorandum are not adequate to support all of the JSOP II recommendations, the Joint Force Memorandum will contain the JCS assessment of risks associated with reducing the JSOP II recommended forces to meet fiscal constraints. This assessment of risk will be made in light of the strategy and objectives of JSOP I and the Strategy Guidance Memorandum. The Joint Force Memorandum will also highlight major force issues to be resolved during the year. Copies of the Joint Force Memorandum will be distributed to the Office of the Secretary of Defense for review, and to the military departments and defense agencies for further guidance in their planning activities.

While this is a new and perhaps difficult role for the Joint Chiefs of Staff, they are moving ahead. The key point is that views of the Joint Chiefs will now be expressed in the context of "real world" fiscal constraints. The Joint Force Memorandum will be of considerable influence in determining force levels and priorities for the military departments and defense agencies. Under the revised PPB procedure, the Joint Chiefs of Staff will participate more effectively in developing the Five Year Defense Program, than has been apparent in recent years.

Program Objective Memorandum

While the Joint Chiefs play a considerable role in the revised procedures, there is also a major increase in tasks and responsibilities of the military departments and defense agencies. In May, each of these components will submit a Program Objective Memorandum which proposes a total military department or defense agency program in terms of forces, manpower and costs. The Program Objective Memorandum (POM), which will be submitted to the Secretary of Defense, is the fourth and final new document in the revised cycle.

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[1] *Because of the time required to revise JSOP-I to reflect significant strategy decisions, and problems inherent in implementing a revised PPB System, only one version of the Strategy Guidance Memorandum was issued in the current cycle.*

The POM will be a comprehensive and detailed presentation of the forces and manpower proposed by each military department or defense agency within the constraints of the Secretary's fiscal guidance. The POMs will also be prepared to reflect JSOP I, the Strategy Guidance Memorandum, and the Joint Force Memorandum. Individual DOD component Program Objective Memoranda will provide rationale for any significant deviation from the Joint Force Memorandum, as well as military gains and/or assessment of risk resulting from these deviations. Specific formats have not yet been provided for the Program Objective Memorandum, other than that it will be structured by major mission and support categories used in the Fiscal Guidance Memorandum.

In certain respects, the Program Objective Memoranda correspond to "For Comment" Draft Presidential Memoranda (DPMs) of the former PPB procedure. However, instead of having initial analysis and presentation alternatives prepared by the Office of the Secretary of Defense, as was the case with the Draft Presidential Memoranda, the Program Objective Memorandum is a document initiated exclusively by a military department or defense agency. And this military department/defense agency document will then be subject to review and comment by the Secretary of Defense, with the help of his staff. This is a highly significant turn of events. It places the burden of detailed initial force planning and tradeoff analysis with the military services and defense agencies, which represents a considerable deviation from previous procedures. The importance of this facet of the procedures was well summarized by Assistant Secretary of Defense (Comptroller) Robert Moot:[2]

> **It is easy, perhaps, to overlook the significance of this change. It requires the [military] services to think systematically about alternatives to current and planned programs. It is the [military] services who must challenge their own programs, design the structure of the analysis, perform the needed research and present their cases in the Program Objective Memorandum.**

Based upon review of individual Program Objective Memoranda by the Secretary of Defense, a seriès of Program Decision Memoranda will be issued to reflect the Secretary's program decisions. It is anticipated that Program Decision Memoranda will be completed by the end of July. However, there is provision for DOD components to express a dissenting view to any of the Secretary's program decisions. The Secretary will direct appropriate staff reviews of any documented dissenting views. Any new decisions resulting from such review will be reflected in modified Program Decision Memoranda. It is anticipated that these reviews will take place during the month of August. Also during the month of August, the Joint Chiefs and Service Secretaries meet with the Secretary of Defense to discuss and resolve any remaining major force issues. This meeting or series of meetings result in final program decisions to be reflected in an updated Five Year Defense Program, prior to starting the budget review portion of the cycle in October.

The budget review process remains unchanged, although introduction of fiscal guidance early in the cycle should make the review less hectic.

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Impact of Revised PPB

It is difficult to isolate any single item as the most significant change. However, even this brief review should serve to indicate that we will have a much more *unified* program and budget operation than in the past. While programming did, in fact, provide a bridge between planning and budgeting, it is still viewed by some as being disconnected from budgeting. The revised procedures are aimed at ensuring that program issues will translate much more readily into budget issues. There is an organizational signal being sounded here, as it is apparent that program analysts and the budget community will have to work much closer than ever before. This is true at the level of the military department and the defense agency, as well as at the level of the Office of the Secretary of Defense.

Perhaps the greatest impact of the revised system is that many detailed planning and programming decisions will be made at a lower level than before. In the past, many of these detailed decisions were made personally by the Secretary of Defense during final weeks of the cycle. The revised system will provide for a greatly increased sharing of the responsibilities leading to major decisions that annually are expressed in the budget. The presence of realistic fiscal constraints early in the year will give each DOD component a much greater voice in determining final configuration of its budget.

While there will be greater military department and defense agency participation at almost every step of the procedure, as well as increased freedom to take the initiative in proposing reallocation of proposed resources, there will also be increased responsibility for ensuring efficient and economical management of resources. And in plain, simple language, this means more analysis, an upgrading in both quantity and quality. This is particularly true when considering that a detailed program-by-program presentation and evaluation of alternatives must be assembled by each military department and defense agency in preparing the Program Objective Memorandum.

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[2] *Address by Robert C. Moot, Assistant Secretary of Defense (Comptroller), to the National War College, Dec. 17, 1969.*

The other item of considerable significance is that programs will be designed around fiscal reality, even in the earliest stages of the cycle. Under previous procedures, a large part of the PPB cycle was spent in working on plans with total costs in excess of finally approved budgets. This necessitated frequently frantic budget trimming from October to December on a program that took nine months to structure. For example, in 1968, the $100 billion September program was reduced to about $80 billion by December, and was later cut to $76 billion by the Congress. Under the revised system, budget submissions will be within constraints of the Fiscal Guidance Memorandum, and the October to December time frame can be used for fine-tuning.

Full impact of the revised procedures will not be felt for a number of months, although some aspects of the revisions were used in preparing the FY 1971 budget. It is important to remember that the PPB revisions were thoroughly planned, discussed and coordinated throughout the entire department—Office of the Secretary of Defense, Joint Chiefs of Staff, the military departments and the defense agencies. The changes represent a composite point of view. By working as a team, DOD components should use the revised PPB procedures to make the FY 1972 cycle one of the best on record.

However, while the proposed system looks good, one must not lose sight of the wisdom quoted in the introduction to this article: "A decision-making process . . . must remain dynamic and susceptible to change if it is to retain its utility."

Economic Analysis

Ordering Spending Priorities

Edward E. Winchester

Domestic priorities versus military priorities. Cost overruns. Poor performance. Late delivery of weapon systems.

Among other things, critics of defense spending cite these reasons to support the premise that there should be more systematic evaluation of defense programs and projects from cradle to grave. General unrest with the war in Vietnam, urgent domestic needs, and the continual pressure of inflation have put this issue squarely before the Congress, the public and the Administration.

Almost a year ago the Council of Economic Advisors predicted that the end of U.S. involvement in Vietnam would bring a "peace dividend" of $22 billion. It is certain that future defense spending will have to compete with social programs for federal funds on the basis of costs and benefits. This fact is obvious from the public attention currently being given to problems of national priorities.

Some critics assert that many defense procurement practices do not make sense. For example: Because helicopters have proved valuable in fighting guerrilla war in certain kinds of Vietnamese terrain, does it make sense to spend a billion dollars equipping all Army divisions—even those prepared to fight on the open terrain of Central Europe—with a full complement of helicopters on top of their regular equipment? Why build nuclear carriers, destroyers, and frigates at nearly twice the cost of conventionally powered ships when the only advantages are very minor increases in cruising speed and range of the Fleet? These are the kinds of questions that must be addressed during the process of making economic analysis of proposed DOD investments.

Approach

In the opinion of Assistant Secretary of Defense (Comptroller) Robert C. Moot, the major objective of determining and justifying programs, priorities, and resource levels within DOD has not been achieved, but a good start has been made by management mechanisms created during the past year.

Taking stock of the Defense Department, Mr. Moot also observed,

> **Every major program in the budget must be supported by an economic analysis; it must be adequately explained; its actual performance must be monitored from a financial management viewpoint. We must discipline ourselves to do this, not only to have a better justified budget, but also to have more effective and economical programs. These economic analyses must be used by management.**

All levels of management are now required to use the so-called "systems approach" to evaluate the cost-benefit implications of defense expenditures. In keeping with the policy of "participatory management," considerable latitude and flexibility has been given to the military services and defense agencies in deciding the methods of analysis and the amount of detail that is to be submitted to the Office of the Secretary of Defense. But, as a general rule, spending proposals will be backed up by a cost-benefit study, cost-effectiveness analysis, or a cost/output tradeoff study.

Obviously a great deal is to be gained from broader application of the systems approach to DOD decision making. The systems approach encompasses economic analysis or systems analysis, systems engineering, value engineering and cost reduction. It has the potential of helping new programs get off to a good start and assuring that obsolete programs, which have outlived their usefulness, are detected at an early stage.

A ready-made market for developing a program analysis capability is developing rapidly. The need to support defense acquisitions with sound economic analysis is causing program initiators to place greater emphasis on cost-effectiveness and cost/output tradeoff studies to justify acquisition of weapon systems and services for national defense. Economic analysis will be an important means of developing public confidence in defense programs by demonstrating that the benefits of spending proposals do, in fact, exceed the costs at any given point in time. Planners and programmers will have to examine deeply program objectives and criteria for accomplishment. The results of these analyses will have to be used in the budget process. At various stages of procurement, and at various levels of detail for a given contract work breakdown structure, an economic analysis may be useful for justifying support and production requirements. Line managers are required to analyze and evaluate the cost-benefit implications of their spending proposals. Quite often only contractor personnel will be able to make these analyses.

Economic analysis can be applied to new investments as well as to ongoing programs. It can also be the basis for evaluating activities and ordering priorities for projects subject to termination when budget reductions are being levied. Program analysis and the analytical techniques of economic analysis are at the very heart of the Planning-Programming-Budgeting System (PPBS) of the Defense Department.

Sound Spending Proposals

In this current environment, managers at all levels must *choose* efficient programs. They will engage in new programs, or continue ongoing programs, only when a convincing case can be made to show that the benefits will clearly outweigh the costs and that alternatives have been considered.

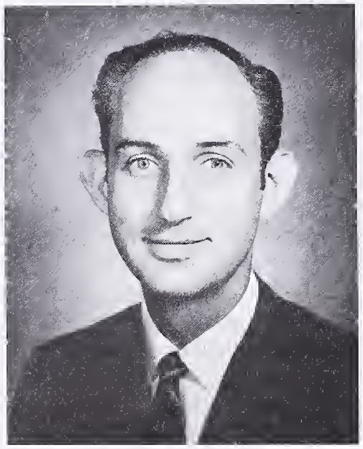
The entire spending policy of the Defense Department must operate within the framework of overall policy and fiscal guidance. This guidance comes from the President to the Secretary of Defense, and flows down from the Secretary to the planning, programming and budgeting staffs of the military services and defense agencies, to individual line managers, and to defense contractors. This "top-down" planning is one approach for integrating economic analysis into the entire decision-making process.

"Bottom-up" planning is full of implications for economic analysis to support planning, programming, and budgeting. Initial development of an investment or spending proposal is likely to be fairly low in the hierarchy of the Defense Department. Most decisions at lower levels of management are highly analyzable entities because of their scope and nature of activities. Deep evaluations of new spending proposals and reappraisal of the need for ongoing activities can be made only at lower levels because needed technical knowledge may exist only in an organizational component far removed from top management.

Zero-Base Budgeting

To put the subject in another perspective, it is important to realize that FY 1971 DOD procurement budgets aggregate more than $18 billion and consist of hundreds of individual line items. Many of these line items consist, in turn, of many subitems which, in and of themselves, may be susceptible to economic analysis. Certainly it would be impractical to try a comprehensive evaluation of all investment proposals at the level of the Office of the Secretary of Defense, where there is a staff of 10 people to review submissions which total between $20 and $30 billion. Therefore, it is necessary to look to the military services and defense agencies to provide assurances that the necessary analytic studies have been used in the budget formulation process. Obviously, only the barest start has been made to use economic analysis to order spending priorities in the Defense Department.

Customarily, the officials in charge of established programs have had to justify only the increases which they sought above the previous year's appropriation. What they had already budgeted was usually accepted as necessary, without re-examination. DOD Instruction 7041.3, "Economic Analy-



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sis of Proposed Department of Defense Investments," Feb. 26, 1969, now provides for evaluation of ongoing programs and reassessment of priorities. It adopts a modified version of the concept of *zero-base budgeting.* In iterative studies of the same investment proposal at successive decision points, when new funding is required, *e.g.*, concept formulation, contract definition, full-scale development, operation and support, an economic analysis should be prepared or updated at the point where the results of the study could influence further investments or expenditure decisions. In other words, a case must be made to justify the entire investment, just as if the program is entirely new.

DOD Instruction 7041.3 establishes policy and procedures for consistent application of economic analysis to proposed DOD investment projects in order to:

- Identify systematically the benefits and costs associated with resources requirements so that useful comparisons of alternative methods for accomplishing a task or mission can be made.
- Highlight the key variables and the assumptions on which investment decisions are based and allow evaluation of these assumptions.
- Evaluate alternative methods of financing investments.
- Compare the relative merits of various alternatives as an aid in selecting the best alternative.

Economic analysis is only a tool for determining the allocation of resources to each program and activity, and for ordering DOD priorities. With respect to costs and benefits, military service and defense agency headquarters must justify program requests and program budget submissions they deem necessary, using, whenever appropriate, the techniques of economic analysis. Ultimately, the budget of the Defense Department will tend to reflect only projects having the highest marginal benefit per dollar of marginal costs.

The Analysis Function

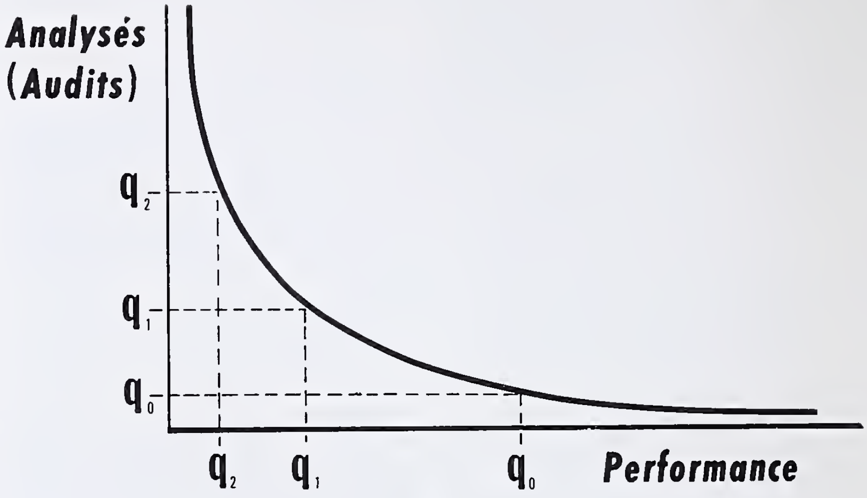

Figure 1.

What Economic Analysis Is

Economic analysis concerns itself with questions of supply and demand. However, the Federal Government deals largely in areas where there is no market place. Accordingly, one function of economic analysis is to provide intelligence about demand, whether for a desired level of military capability, a new wing of tactical aircraft, military housing units, etc.

Another function of economic analysis is to provide information to justify requests for funds to meet those demands, and to provide for ordering priorities of spending programs of the Defense Department based on their costs and benefits.

Other forms of analysis may be undertaken to increase efficiency of operations. However, the focus of attention will be on an organization's objectives and on the cost and benefits of the investments it recognizes as being important to accomplish those objectives. Emphasis is placed on ordering priorities and evaluating investments.

Strong emphasis is now being placed on decentralization in the Defense Department. Professional military people are being given more responsibility and authority for making recommendations and executing military plans. Economic analysis, as a subset of the Planning-Programming-Budgeting System (PPBS), is a major step to bring both PPBS and economic analysis "down the chain of command."

At the suggestion that proposed expenditures be backed up by an economic analysis in accordance with DOD Instruction 7041.3, some misconceptions are likely. It is sometimes said that economic analysis applies only to problems which can be quantified. Some may say it is not very useful for evaluating investments for research and development and expenditures which are justified on the basis of military necessity. Others view analysis as applying only to acquisitions of plant and equipment; only for estimating dollar savings. Some may believe that it does not involve technical and performance considerations, and unquantifiable factors such as health, safety, or security.

Fundamental to economic analysis is the concept of "open and explicit analysis." Economic analysis is open and explicit if it is presented so that the objectives and alternatives of investments are clearly defined, costs and benefits are identified, and all the important assumptions, factors, calculations, and judgments are clearly presented. From such analysis, interested parties can see exactly how recommendations were derived. Propositions can be checked for logic. Questions of fact can be tested against factual evidence. Matters of value and uncertainty can be exposed and clarified. Decision makers will know exactly where to apply judgment. Thus, economic analysis is an aid to judgment, not a substitute for judgment. It helps by isolating the potential significance of each of the investment alternatives.

The term "investment," as used in DOD Instruction 7041.3, applies to more than just capital acquisitions of plant and equipment. A definite distinction is drawn between *investment* and *investment costs*. In a broad sense, an investment is an acquisition of goods and services. This includes any expenditure, *e.g.*, leaseholds, procurement of equipment or services, and other non-capital acquisitions. An investment is an expenditure made in the expectation of realizing benefits. It may involve recurring and nonrecurring costs (research and development costs, investment costs, and operating costs), as well as tangible and intangible benefits and indicators of effectiveness and output.

DOD Instruction 7041.3 differentiates between two key economic concepts: "equal cost" (isocost) and "equal benefit" (isoquant). Its two primary objectives are:

- Identification of cost reduction/least cost investment alternatives.
- Improvement of effectiveness or performance of both new and ongoing programs.

In other words, economic analysis is primarily a set of concepts for evaluating the costs and results of expenditure.

Need for Economic Analysis

Sound economic analysis is an essential part of the process of ordering spending priorities for the Defense Department. In an environment where demand exceeds the available supply of funds and fiscal guidelines impose budget constraints, investment proposals must be evaluated on their relative merits, and priorities established. In other words, the analytical techniques of economic analysis must be used by management at all levels. It is only by determining progams and projects which are capable of attaining required objectives, programs which have outlived or attained required objectives, and programs whose benefits are in excess of their costs that it is possible to begin to lay a basis for ordering priorities. This is the purpose of economic analysis.

The relationship between the level of performance of defense programs and the amount of analysis which is needed is depicted in Figure 1. There is little incentive or demand for analysis when program performance is high. Conversely, the lower the level of performance, the greater is the need for analysis. Unfortunately, the precise position of the Defense Department on this conceptual schematic can be ascertained only by means of empirical observations and investigations.

One source of empirical data, which is useful for demonstrating the level of performance, is the Comptroller General's Annual Report. For example, total dollar collections and other measurable savings in the Defense Department for the period of FY 1965–68, attributable to the General Accounting Office, amounted to $436 million. To this figure could be added measurable savings resulting from internal DOD audit activities, and savings resulting from the value engineering, cost reduction and suggestion programs. The total amount of savings, of course, is an unknown, but it is bound to be substantial. The many reports submitted to Congress alleging waste and inefficiency, and ways of improving program performance, are other indicators of the need for greater emphasis on analysis by the Defense Department.

Changes in the level of program performance are generally caused by:

- Pursuit of new investment alternatives, options, and ways of doing business which will result in improved performance and greater efficiency.
- Failure of individuals to properly analyze and evaluate the consequences of expenditure decisions.
- Failure to control and conduct

DOD Component Regulations Applying to Economic Analysis

Military Service or Defense Agency	Implementing Document	Date
Army	Army Regulation 37–13	June 4, 1969
Air Force	Air Force Regulation 172–2	Dec. 30, 1969
Navy	SECNAV Instruction 7000.14	June 30, 1970
Defense Communications Agency (DCA)	DCA Instruction 600–60–1	June 25, 1969
Defense Intelligence Agency (DIA)	DIA Regulation 45–8	April 24, 1969
Defense Atomic Support Agency (DASA)	DASA Regulation 7041.3	Sept. 26, 1969
Defense Supply Agency (DSA)	DSA Regulation 7041.1	June 10, 1969
Defense Contract Audit Agency (DCAA)	DCAA Regulation 7041.1	Oct. 1, 1969
National Security Agency (NSA)	NSA Comptroller Memorandum No. 30	June 10, 1969

Figure 2.

ECONOMIC ANALYSIS TO SUPPORT PROCUREMENT DECISIONS

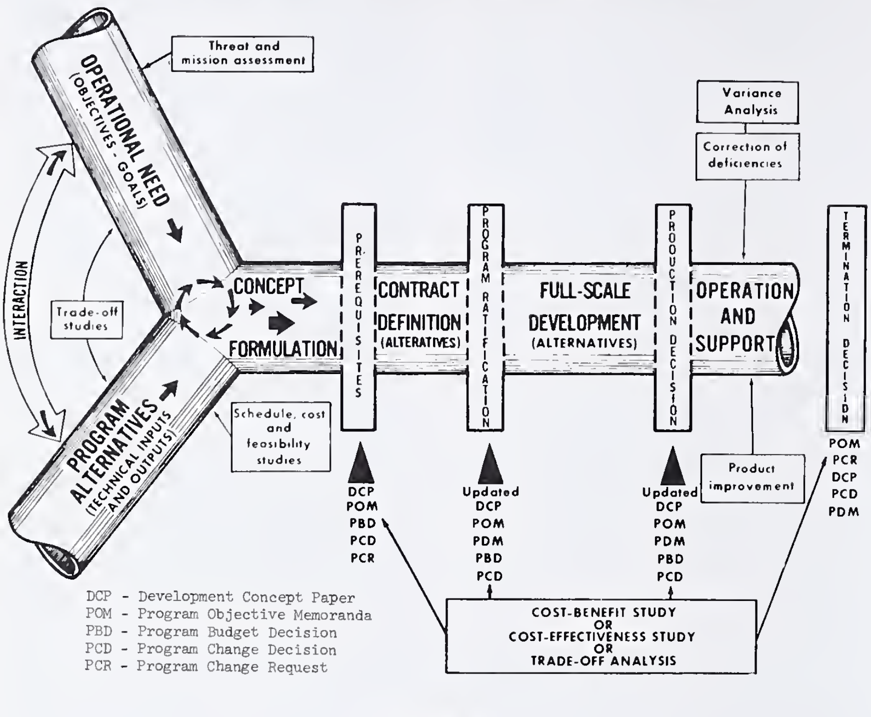
Threat and mission assessment
OPERATIONAL NEED (OBJECTIVES - GOALS)
INTERACTION
Trade-off studies
PROGRAM ALTERNATIVES (TECHNICAL INPUTS AND OUTPUTS)
Schedule, cost and feasibility studies
CONCEPT FORMULATION
PREREQUISITES
CONTRACT DEFINITION (ALTERNATIVES)
PROGRAM RATIFICATION
FULL-SCALE DEVELOPMENT (ALTERNATIVES)
PRODUCTION DECISION
OPERATION AND SUPPORT
TERMINATION DECISION
Variance Analysis
Correction of deficiencies
Product improvement
DCP POM PBD PCD PCR
Updated DCP POM PDM PBD PCD
Updated DCP POM PDM PBD PCD
POM PCR DCP PCD PDM
COST-BENEFIT STUDY OR COST-EFFECTIVENESS STUDY OR TRADE-OFF ANALYSIS
DCP - Development Concept Paper
POM - Program Objective Memoranda
PBD - Program Budget Decision
PCD - Program Change Decision
PCR - Program Change Request

Figure 3.

adequate analysis of ongoing programs and activities.

Greater use of the economic concepts, which form a necessary part of program analysis, is one way of achieving economic efficiency and an optimum level of performance in DOD operations.

Need for Written Guidance

It is possible to have effective and efficient management systems, such as the PPB System, without written policies. But the relative formalism, which is an essential characteristic of the PPB System makes it desirable to have certain basic policies made explicit, to assure that those policies and procedures are followed. When PPB responsibilities are decentralized and analyses are made at various organizational levels, it is even more important to have written instructions to assure consistency in the application of specific policies and procedures.

Regulations implementing economic analysis in DOD components are listed in Figure 2 (page 7). These guidelines should have a significant impact on the preparation of the FY 1972 defense budget.

The basic requirement for tradeoff studies and cost-effectiveness analysis is also the heart of the new System Engineering Management Program (Military Standard 499). It provides criteria for defense contractors to follow in determining the optimum choice among technically feasible alternatives from a mission performance point of view. Military Standard 499 is, therefore, a logical complement to DOD Instruction 7041.3. The role of economic analysis in the procurement process is shown in Figure 3.

Efforts to institute economic analysis of policy issues in DOD is by no means complete. There is still a long way to go to ensure that economic analysis is incorporated in the decision process in DOD.

For many program planners the written guidelines present little that is new. Economic analysis may merely help to improve the quality of analyses which are normally done. Where it has not been used, hopefully changes will occur. Much more emphasis will have to be placed on using economic analysis, particularly in the budget process. Since the federal budget brings program priorities more sharply into focus than anywhere else, the challenge is to gain an understanding of the requirements underlying the budget and the potential impact of reordering priorities. This understanding must be communicated to all segments of our society. The challenge has been particularly acute for the DOD portion of the federal budget, since virtually all the pressure has been for decreases.

Controlling Expenditures

The actual costs and benefits of existing programs are often at a disadvantage when compared with the promised costs and benefits of proposed programs. While DOD Instruction 7041.3 currently provides only for pre-expenditure evaluations, economic analysis *per se* may be viewed as diagnostic, as well as prescriptive. Through the application of analytical techniques, it is possible to make an economic analysis or evaluation of past investments and ongoing programs and activities.

It has been suggested that DOD Instruction 7041.3 be supplemented with provisions for variance analysis of actual performance with planned performance. A "closed loop" of this nature is necessary to establish credibility for cost-benefit studies. Furthermore, performance measurement is essential to maximize actual performance, output, benefits, and savings. Otherwise, PPB will not be a "system" because it will not have a feedback capability. Users of the instruction should be alert to this particular shortcoming. There is a need to use economic analysis on a post-expenditure basis to evaluate performance, and to identify necessary corrective actions for situations which fall outside acceptable parameters.

To strengthen this control function, the Assistant Secretary of Defense (Comptroller) has requested the Service Secretaries and Defense Agency Directors to place greater emphasis on performance (output) measurement. He urged that managers at all organizational levels relate specific goals and accomplishments to broad organizational goals by establishing goal-setting and performance measurement programs. When the missing link, performance measurement, in the existing PPB process is fully developed and implemented on a broad scale, there will be much greater likelihood of effecting increased economies and efficiencies within DOD.

Summary

From the foregoing it can be seen that, even though economic analysis stresses the use of scientific, quantitative techniques, it also makes use of expert intuition and judgment.

It is important to be specific about costs and benefits, even if it is not possible to quantify. The analyst should take a wide view in identifying the consequences of proposed expenditures and identify both quantifiable and non-quantifiable consideration—call them externalities, side-effects, spill-overs, repercussion effects, or what have you. If they are relevant and significant, they should be identified in the analysis.

It is easy, unfortunately, to exaggerate the degree of assistance that economic analysis can offer the policy maker or the decision maker. At most, it can only aid him in understanding relevant alternatives and key assumptions by providing estimates of the cost, risks, payoffs, and other implications associated with each course of action. Hopefully, it will lead him to consider new and better alternatives, and sharpen his intuition and broaden his basis for judgment, thus helping him to make better decisions.

The thrust of economic analysis is toward specificity, not quantification. Provisions have been made in the DOD Instruction 7041.3 for using various kinds of analytical techniques. Economic analysis is not synonymous with the application of computer technology or sophisticated mathematical techniques. Many important analyses may not use them. The purpose of DOD Instruction 7041.3 is to encourage careful and explicit evaluation of defense programs and activities through the use of an appropriate analytical framework.

The full benefits of economic anlysis will not be realized immediately. Only as people at the lower echelons of DOD use economic analysis will its full potential be realized. However, from what has been said concerning the status of implementation, it is evident that aggressive follow-up actions by the military services, defense agencies, and defense contractors will be necessary to ensure that economic analysis is, in fact, tied into the entire decision-making process of the Defense Department.

Output Information: Ask the Right Questions

Colonel E. G. Wale, USAF

Daily, as we read newspapers and magazines, listen to political speeches, or watch the TV news programs, it becomes even more apparent that these are "dog days" for many federal activities. With public demands for goods and services growing apace with the population explosion, new technological achievements, and continuing economic prosperity, the funds allocated to many federal agencies are not keeping step with increasing demands. As a consequence. many federal agencies are faced with the problem of providing increasing goods and services with relatively decreasing budgets. From the President and Congress down through the departments to the program managers, key words in the decision-making process are "justify," "substantiate," and "prove." In this environment, every manager is pressed toward devoting considerable energies to the development of a better capability to ask the right questions.

In the past few years, giant strides have been taken by many federal agencies toward improving their managerial techniques and skills. Many promising and innovative management systems have been put into operation—some good, some bad, some resulting in auditable savings, some in expensive waste. The challenge to the Office of the Secretary of Defense (OSD) in these dog days is to take inventory, to re-evaluate our needs, to weed out the ineffective, to eliminate the extraneous, and to refine and perfect those management systems which have proved their worth—that are paying their way. In short, our role is to provide the military departments and defense agencies with policy, guidance and assistance, as well as tools that will help them to make better decisions.

Most readers will recall that efforts to introduce systematic planning, programming, budgeting and analysis into the decision-making process began in the Defense Department. DOD was the first government agency in the business. Under the leadership of former Secretary of Defense Robert S. McNamara, Charles Hitch, then the Comptroller, and Alain Enthovern, head of the new Systems Analysis organization, for the first time developed and used performance and cost information to maximize rational consideration of, and choice among, alternatives. The success of this effort stimulated the proposal to apply a similar approach in all federal agencies and departments.

On Aug. 25, 1965, former President Lyndon B. Johnson issued an executive order establishing a comprehensive Planning-Programming-Budgeting (PPB) System throughout the Federal Government. In his words, the objectives of this system were to encourage public decision makers to:

- Identify our national goals with precision and on a continuing basis.
- Choose among those goals the ones that are most urgent.
- Search for alternative means of reaching those goals most effectively at the least cost.
- Inform ourselves not merely on next year's costs, but on the second, the third, and subsequent years' costs of our programs.
- Measure the performance of our programs to ensure a dollar's worth of service for each dollar spent.

Colonel E. G. Wale, USAF, was a management analyst in the Office of the Deputy Assistant Secretary for Systems Policy and Information, Office of the Assistant Secretary of Defense (Comptroller), when he wrote this article. He has since been assigned as military assistant to the Director, Advisory Group for Aerospace Research and Development, Paris. He holds a bachelor of science in mechanical engineering from Denver University, and a master of science in research and development management from the Air Force Institute of Technology.

Since President Johnson's directive, approximately 25 federal agencies have initiated the development of Planning - Programming - Budgeting Systems. Examination reveals that they differ widely in structure, quality and utility. Additionally, and for the first time, the FY 1970 budget is comprised of breakouts of expenditures by programs for several of the federal agencies, using accountability systems similar to those that have been in use throughout the Defense Department. The unity of purpose and utility of this kind of breakout is obvious, despite the limitations imposed by its high level of aggregation and the lack of output information or benefit measures. However, many questions about the rationale for this particular means of portraying national expenditures may be raised.

Measuring Achievement

It would appear that the most vital among these questions is the glaring and universal inadequacy of these structures to provide meaningful and useful measures of achievement and effectiveness. In general, the systems, presently being promulgated and developed, do not adequately reflect the outputs associated with the decisions under consideration, as required by the President's executive order or as expressed in Bureau of the Budget Bulletin No. 68–9.

In reviewing this bulletin, the reader will note that a program element is the basic unit of the program structure, and that its characteristics are almost completely based on output information. The definition for program elements as stated in this bulletin is:

> ***Program Elements.*** **A program element covers agency activities related directly to the production of a discrete agency output, or group of related outputs. Agency activities which contribute directly to the output should be included in the program element, or financed from different appropriations. Thus, program elements are the basic units of the program structure.**
>
> **Program elements have these characteristics: (1) they should produce clearly definable outputs, which are quantified wherever possible; (2) wherever feasible, the output of a program element should be an agency end-product; and (3) the inputs of a program element should vary with changes in the levels of output, but not necessarily proportionally.**

If we apply this definition, it is readily apparent that the development and establishment of long term program planning, and the guidance and evaluation of year-to-year program management, require generation and use of output information. Such output information or benefit measures must be capable of reflecting the degree of accomplishment of broad national goals, as well as system or organization objectives. It must be sensitive to changes in the costs expended to reach these goals.

Admittedly, problems of defining, interrelating, analyzing, and coordinating major federal programs are large and complex. Quite often there is a tendency to be overly optimistic about our understanding of a program's objectives. The usual, relatively simple "milestones" or "yardsticks" are not related closely enough to the true end values that underlie the program's purpose. However, relatively available measurement techniques, such as level of effort, work measurement, or productivity, can often meet this requirement for output information.

In addition, it is important that federal agencies establish incentives to use analytical information. Formal structures must exist within the agency to use this information in the decision-making process. Finally, the measurement techniques must specifically relate to the purposes and objectives of the program.

Without such structures, organizations as large and complex as those in the Federal Government can expend considerable resources in reporting, analyzing and evaluating information that has no real value in making decisions on proposed or existing programs.

Identifying Output Information

A vital need, at the present stage of development of PPB structures in most federal agencies, is a vast improvement in the output side of the input-output equation as it applies to resource management. An objective and pragmatic interpretation of the philosophy expressed in Bureau of the Budget Bulletin 68–9 demands a shift in emphasis from input management, or resources counting, to output management, or benefit measurement. At a minimum, a reasonable interpretation dictates recognition of the equality of input measurement and output measurement in the decision-making arena. Application of this new emphasis to PPB structures will lead to better identification of program objectives and the criteria against which progress can be measured. Additionally, it will provide more meaningful ways to evaluate the relationships between input and output, so that the decisions made and the policies pursued will more effectively contribute to the results desired.

For decisions on programs yielding products or gains which do not appear susceptible to the development of output or benefit measures, the problem appears to become particularly complex. The danger is that managers or decision makers may tend to concentrate on efforts or products which are more easily quantified. They may tend to overlook or denigrate those which appear to be incommensurable—even though the latter may be more meaningful to the true purposes or objectives at hand. Thus, the problem is compounded by the difficulties of developing meaningful and useful measures of value received or expected, even when provision is made to include output information in the PPB structure.

In this respect, an argument is often heard that federal agency outputs cannot be readily identified or quantified because they are often unmeasurable or intangible. This mistaken impression seems to arise from confusing a program's objectives or an organization's missions with its products. In reality, the objectives or missions are often intangible while the products or outputs are not. It is the former which must be better identified. Conversely, we must recognize that the mere ability to count is not necessarily an indication that we know how to measure output. The goal is to realistically evaluate the degree of efficient use made of allocated resources in getting desired outputs. Outputs are not efficient if they do not achieve the goal. Thus, programs or organizations may be effective in producing outputs, but inefficient in achieving the desired end results. This is one of the dilemmas which must be resolved.

In any complex organization, program decisions are made and resources are allocated and consumed every day. The problem which must be faced is to make better allocation and employment decisions. It seems reasonable that a better understanding and measurement of the resources consumed (inputs) and the results accomplished (outputs) of all possible courses of action will improve the decision-making processes. A thorough search for clearer identification of what must be accomplished, how it is to be done, and how to measure achievement should lead to a more systematic way of satisfying the need for better decision making.

To even the uninitiated or the casual observer, it is obvious that the Federal Government is deeply involved in the production and distribution of goods and services. The Government should, therefore, specifically identify its outputs so that they may be more properly evaluated, not merely in terms of stated programs and their associated milestones, or by reference to relative levels of effort or input workloads, but by determining the "true" value or benefit of each

Classes of Output Information

Class	Type of Output
A	**Social Values.** Public benefits which are equally available to all. Individuals or groups cannot be excluded from these benefits regardless of whether they contributed to their provision. Examples: national defense, law enforcement, the space program, or a TV broadcast covering a public event.
B	**External Benefits.** Products of one organization expressed in terms of benefits received by other organizations. Examples: adequacy and quality of repaired engines as received by operating units, tactical assistance resulting from effects of ordnance delivered.
C	**Organizational Products.** Description of what is produced by an organization for external use or effect. Examples: number of engines repaired, amount of ordnance delivered.
D	**Evaluated Work Measures.** Description levels of activity in terms reflecting efficiency and effectiveness through application of engineered, historical, or postulated standards. Example: earned man-hours.
E	**Levels of Activity (Unevaluated).** Number of man-hours used or units of work performed. Examples: number of overtime hours worked, number of square feet covered, number of personnel trained (without precise definitions of "worked," "covered," or "trained").
F	**Reclassification of Cost Information.** Sometimes permits output information to be inferred. Examples: number of personnel assigned; number of activities managed, dollar value of activity managed.

Figure 1.

output. In this respect, most students of this subject contend that the evaluation or measurement of value or benefit can best be made by that segment of the public domain which receives, uses, or consumes the goods or services produced by a program. Much progress has been achieved. However, it often seems that these requirements are not completely satisfied by several of the PPB Systems currently being developed by our federal agencies. In many cases, these systems are oriented too closely to budget and financial requirements, and many times are not directed toward answering more significant economic questions which underlie the decision-making process.

Improving Methods in DOD

During the past year, the Office of the Assistant Secretary of Defense (Comptroller) has been developing some ideas which may help resolve these problems and improve DOD's ability to ask the right questions. Further expansion and refinement of these ideas should lead to an improved ability to better identify output information in terms of the true program objectives desired, and to better relate output information to the accounting structures which have been put into operation.

First, DOD is beginning to recognize that there probably is a "spectrum," or range, of output information (Figure 1, page 11). This concept of a spectrum of types of output measures is intriguing and tentatively very useful. For example, one can speak of measures of output at the very lowest level as amounting simply to reclassifications of cost data. Moving upward in value, output might be expressed in terms of unevaluated levels of activity, in terms of evaluated work measures, in terms of organizational products, in terms of the external benefits and, at the highest level, as social values. Outputs at the lowest of these levels seem to be most easily described, and most difficult to describe at the highest. In any case, if one describes an output at the lowest level on the spectrum, it is then possible to aim for a target of describing it one level higher. This makes some

Examples of the Use of Output Information in the DOD PPB System

FYDP Program Element	Output Information	Class (Spectrum)
B–52 Squadrons	Degree of Assurance of Survival of the U.S. Population	A-Social Value
Military Survival Measures (Nuclear Attack)	Percent of Population Protected by Standard Passive Defense Measures	A-Social Value
Attack Carriers	Degree of Tactical Assistance Resulting from the Effects of Ordnance Dropped in Air/Ground Close Support of Army in Vietnam	B-External Benefit
C–5 Airlift Squadrons	Measurement Tons of Cargo Deliveries to Operational Units in Useable Condition and On Time	B-External Benefit
Military Academies	Number of Graduates Commissioned	C-Organizational Product
Logistic Support Activity	Ton-Miles of Second Destination Transportation	C-Organizational Product
Inventory Control Points	Number of Man-Hours Earned	D-Evaluated Work Measure
Hospitals	Composite Work Units	D-Evaluated Work Measure
Education Programs	Number of Students Enrolled in U.S. Armed Forces Institute Courses	E-Level of Activity
Military Family Housing	Number of Family Units Maintained	E-Level of Activity
Industrial Preparedness	Acquisition Cost of Reserve Plants or Dollar Value of Industrial Plant Equipment	F-Reclassification of Costs
Retired Pay	Number of Retired Persons on Roster	F-Reclassification of Costs

Figure 2.

of the problems discussed before a little more manageable.

Classification of output information into a formal structure, similar to this example, may assist in identification and use of the so-called unmeasurable or intangible outputs. Clarification of the true objectives of programs in terms of specific benefit measures should be enhanced. Also, building of formal PPB structures which include output information may be facilitated, thus enabling more emphasis on output information and more incentive for managers and decision makers to consider outputs as well as inputs.

In Figure 2, program elements from the DOD Five Year Defense Program (FYDP) have been selected as examples of the application of output information for each class in the spectrum. The program element is the basic building block for the PPB System.

A word of caution is necessary. The make-up of this illustrative chart might lead the reader to believe that only one output measure is desired for each program element, or that only one class of output information applies to an individual program element. In practice, the converse is true. Each program element will probably require several meaningful or critical output measures. Additionally, each class of output information may apply to a given program element, depending on the interest and level of the decision maker, *i.e.*, DOD military department or subordinate military organization, the type of function, or the organization structure. These two points cannot be overemphasized.

The second idea under consideration is a simple mechanized format which will permit comparison of forecast costs and outputs with actual costs and outputs.

At present DOD is conducting tests limited to selected program elements in the Five Year Defense Program. These tests are aimed at determining availability, validity, accuracy and utility of cost/output data, as well as the cost of capturing this information. Again, the basic building block is the program element.

Provision is made for displaying the data for each military department and defense agency which is allocated funds under a given program element. Provision is also made for DOD totals. At present, DOD envisages use of forecast costs as generated and reported in the annual budget cycle. Current-year data in this instance will probably require further breakdown into fiscal-year quarters. Actual cost data will be that currently required by DOD Instruction 7000.5, "Operations Subsystem to the Five Year Defense Program." Forecast and actual output data are being generated from currently available data for a limited number of program elements on a test basis.

While the limited data captured in our tests to date constitute a very small sample, and the application of the spectrum of output information idea is constrained by the relatively small number of organizations and functions considered, we are beginning to identify several potential problem areas. Among these problems are:

- Extremely high level of aggregation of both costs and outputs at the program element level.
- Apparent lack of uniformity of interpretation and application of program element definitions by DOD components (military departments and defense agencies).
- Wide variations in cost/output ratios from component to component for seemingly similar activities.
- Difficulties in determining or selecting the proper level of detail required to fulfill the mission of the Office of the Secretary of Defense of formulating policy and giving guidance and assistance.
- Questions revolving around the validity and accuracy of data.
- Difficulties in determining the time lapse between cost incurrence and impact on output.
- Use of discrete versus cumulative data.

A summary of this type may for the first time provide a thumbnail picture of the overall trend of a program, facilitate evaluation of the current status, and provide an overview of intra-service/intra-agency relationships. This body of data probably will not be installed in a recurring report form, but rather will be stored at the DOD component level for call-up at any time by specific users. Potential uses are "highlight" review for top level management, trend analysis, back-up for budgetary exercises, a base for organization command level reviews, and as a source for substantiation data for Program Objective Memoranda and Program Change Requests.

These applications, we believe, will significantly improve our capability to "ask the right questions."

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MEETINGS AND SYMPOSIA

MAY

Image Amplification and Photography Related to Reconnaissance, May 18–22, in New York, N.Y. Co-sponsors: Air Force Office of Scientific Research and the Society of Photographic Scientists Engineers. Contact: Dr. W. L. Ruigh, Air Force Office of Scientific Research (SRC), 1400 Wilson Blvd., Arlington, Va. 22209. Phone (202) 694–5337.

Twenty-fourth Annual **Power Sources Symposium**, May 19–21, at the Electronic Components Laboratory, Army Electronics Command, Fort Monmouth, N.J. Co-sponsors: Electronic Components Laboratory, Army Electronics Command, and the Interagency Advanced Power Group. Contact: David Linden, Deputy Chief, Power Sources Division, Electronic Components Laboratory, Army Electronics Command, Fort Monmouth, N.J. 07703. Phone (201) 535-2084.

Sixth **Naval Material Command Systems Performance Effectiveness** (SPECON 6) Conference, May 20–21, at the West Auditorium, State Department, 23rd St. between C and D Sts. NW, Washington, D.C. Sponsor: Department of the Navy. Contact: George W. Neumann, Executive Secretary, SPE Steering Committee, Naval Ship Systems Command, Washington, D.C. 20360. Phone (202) OXford 6–3097.

Eighth Annual **Interagency Data Exchange Program** Workshop, "Technical Information Exchange Through Interagency / Industry Cooperation," May 25–27, at the Cosmopolitan Hotel, Denver, Colo. Sponsor: Interagency Data Exchange Program. Contact: Roy W. Hall Jr., Chairman of Arrangements, IDEP Workshop, c/o Martin-Marietta Corp., Denver, Colo. 80201. Phone (303) 794–5211.

Sixteenth **Army Mathematicians** Conference, May 27–28, at the Army Strategy and Tactics Analysis Group, Bethesda, Md. Sponsor: Army Research Office—Durham on behalf of the Army Mathematics Steering Committee. Contact: Dr. Francis G. Dressel, Mathematics Division, Army Research Office—Durham, Box CM, Duke Station, Durham, N.C. 27706. Phone (919) 286–2285, Ext. 75.

JUNE

Phased Array Antenna Symposium, June 2–5, at the Polytechnic Institute of Brooklyn, Campus at Farmingdale, N.Y. Sponsor: Chief of Army Research and Development. Contact: Lindsay B. Anderson, Assistant Director/Chief, Radar Systems Division, Army Advanced Ballistic Missile Defense Agency, Commonwealth Building, 1320 Wilson Blvd., Arlington, Va. 22209. Phone (202) OXford 4–2752.

Advanced Planning Briefing for Industry on Naval Electronic Systems (classified), June 9–11, at the Naval Ordnance Laboratory, White Oak, Silver Spring, Md. Co-sponsors: Naval Material Command and the Electronic Industries Association. Contact: Mrs. Jane Davis, Electronic Industries Association, 2001 Eye St., NW, Washington, D.C. 20006. Phone (202) 659–2200.

Fifth **Molecular Crystal** Symposium, June 9–11, at the University of Pennsylvania, Philadelphia, Pa. Sponsor: Army Research Office—Durham. Contact: Lt. Col. Edgar G. Hickson Jr., Army Research Office—Durham, Box CM, Duke Station, Durham, N.C. 27706. Phone (919) 286–2285.

Heat Transfer and Fluid Mechanics Institute Conference, June 10–12, at the Naval Postgraduate School, Monterey, Calif. Co-sponsors: Army Research Office—Durham and the National Science Foundation. Contact: James J. Murray, Engineering Sciences Division, Army Research Office—Durham, Box CM, Duke Station, Durham, N.C. 27706. Phone (919) 286–2285, Ext. 39.

Sixth **Mathematical Statistics and Probability** Symposium, June 22–July 17, at the University of California, Berkeley. Sponsors: Department of the Army, Office of Naval Research, National Institutes of Health, National Science Foundation and the University of California. Contact: Fred Frishman, Chief, Mathematics Branch, Army Research Office, Office of the Chief of Research and Development, Washington, D.C. 20310. Phone (202) OXford 4–3356.

JULY

Twenty-sixth **Solid Propulsion** Meeting, July 14–16, at the Sheraton Park Hotel, Washington, D.C. Sponsor: Joint Army, Navy, Air Force and NASA Interagency Propulsion Committee. Contact: T. M. Gilliland, Chemical Propulsion Information Agency, Applied Physics Laboratory, Johns Hopkins University, 8621 Georgia Ave., Silver Spring, Md. 20910. Phone (301) 589–7700.

AUGUST

Fifth **International Detonation** Symposium, Aug. 18–21, at Pasadena, Calif. Co-sponsors: Office of Naval Research and the Naval Ordnance Laboratory. Contact: Dr. S. J. Jacobs, Naval Ordnance Laboratory, Silver Spring, Md. 20910. Phone (301) 495–8404.

Thirteenth **International Combustion** Symposium, Aug. 23–29, at the University of Utah, Salt Lake City, Utah. Sponsors: Departments of the Army, Navy and Air Force, National Science Foundation, National Aeronautics and Space Administration, and the Combustion Institute. Contact: Lt. Col. Edgar G. Hickson Jr., Army Research Office—Durham, Box CM, Duke Station, Durham, N.C. 27706, phone (919) 286–2285; or Dr. B. T. Wolfson, Air Force Office of Scientific Research (SREP), 1400 Wilson Blvd., Arlington, Va. 22209, phone (202) 694–5337.

NATO Industrial Advisory Group

William C. Kruse

An outgrowth of the May 1968 meeting of the Conference of National Armaments Directors (CNAD) of the North Atlantic Treaty Organization (NATO) was a recommendation to establish a NATO Industrial Advisory Group (NIAG), composed of senior industrialists from the NATO countries. In October 1968, the North Atlantic Council passed a resolution establishing NIAG as a formal body of the council. The main purpose of NIAG is to assist and advise CNAD in stimulating increased cooperation in joint research, development and production among NATO countries.

As a high level consultative and advisory body, the prescribed objectives of NIAG are to:

- Provide a forum for free exchange of views on the various industrial aspects of NATO armaments questions.
- Foster a deeper feeling of international involvement in research, development and production, and seek closer cooperation among the industries of member countries.

The group's "terms of reference," within the scope of its activities, shall be to:

- Note information, originating from CNAD or its subordinate groups, relating to various national or common trends in future items of military equipment, and any problem upon which the advice of industry is desirable.
- Consider and comment on NATO procedures and practices insofar as they affect industry.
- Study the factors affecting cooperation at the industrial level and develop practical proposals.
- Seek and propose solutions to problems of an industrial nature, concerning particular armaments projects, which have been submitted to NIAG.
- Make recommendations for improving the exchange of information between NATO and defense industries of member countries.
- Make any other recommendations to CNAD which it considers appropriate.
- Report to CNAD.

Selection of Delegations

Following the decision by the North Atlantic Council to create NIAG, the next step for the nations was to select delegations of industrialists. All NATO nations except Iceland and Luxembourg decided to participate. The method of selection was to be at the discretion of each nation, but with an agreed general principle that the industrialists would represent their countries' industries as a whole, and that they should have latitude in their deliberations to express their industry views, not necessarily those of their governments. It was also agreed that the maximum number of industrialists in each country's delegation would be four.

The Defense Department decided to ask four major defense industry associations to select members to serve on the U.S. delegation to NIAG. Six individuals were chosen, one from each of the four associations and two chosen jointly by the four associations. As it was anticipated that it might be difficult to find meeting times convenient to all four industrialists at the same time, it was decided to appoint a total of six to ensure adequate attendance. Members of the first U.S. delegation were:

Noel B. McLean, Chairman, Edo Corp., selected by the National Security Industrial Association.

Forest W. Crowe, Vice President and General Manager, UNIVAC, selected by the Electronic Industries Association.

Willis M. Hawkins, Vice President, Science and Engineering, Lockheed Aircraft Corp., selected by the Aerospace Industries Association.

Elmer P. Wohl, Staff Vice President, Administration, North American Rockwell Corp., selected by the American Ordnance Association.

Jointly selected by the four associations were:

Mansfield B. Sprague, Vice President, Corporation Programs, American Machine and Foundry Co.

Robert Kirk, Vice President, International Telephone and Telegraph Corp.

Messrs. Crowe, Wohl and Sprague were chosen for two-year terms, and the others for one year. Mr. McLean was elected chairman of the delegation for 1969 by his colleagues; Mr. Wohl was elected vice chairman. Mr. Wohl is the 1970 chairman of the delegation.

Replacements for Messrs. McLean, Hawkins and Kirk have been selected to serve on the delegation in 1970. They are:

Robert E. Lewis, Chairman of the Executive Committee, Perkin-Elmer Corp.

Thomas J. Murrin, Executive Vice President, Defense Industry and Defense Products, Westinghouse Electric Corp.

George E. Todd, Vice President, Hughes Aircraft Co.

The term of service for each delegate will now be two years, ensuring rotation of half the delegation each year.

Administrative Operations

NIAG is headed by a chairman and vice chairman, selected from the country delegations. A planning committee, composed of the chairmen of each delegation, meets several weeks prior to a plenary session to develop agendas, and may act for and on behalf of the NIAG as a whole. A total of seven chairmen constitutes a quorum.

NIAG meets in plenary session three or four times each year and at subcommittee levels, as required. Two government observers attend plenary sessions and, if specifically invited, at subcommittee levels. Meetings at both plenary and subcommittee levels are generally held at NATO headquarters in Brussels, Belgium. Administrative arrangements are made by the NATO international staff, with assistance from the various national delegations to NATO. The staff of the Assistant Secretary General for Defense Support of the NATO Secretariat, in addition to administrative support, provides advice, counsel and coordinating services.

William C. Kruse has been Staff Director, International Armaments Division, in the Office of the Assistant Secretary of Defense (Installation and Logistics) since September 1963. Before entering government service, he was Managing Director of Sharples Italiana, Milan, Italy, a wholly owned subsidiary of Sharples Corp. of Philadelphia. From September 1960 to August 1963, he served as Director of Production and Logistics, U. S. Mission to NATO, Paris, France. Mr. Kruse holds a bachelor of arts degree in political science from Cornell University.

Within the U.S. Defense Department, the Assistant Secretary of Defense (Installations and Logistics) has primary responsibility for NIAG matters in close coordination with the Director, Defense Research and Engineering. Observers for the U.S. Government are the Assistant Secretary of Defense (Installations and Logistics) and the Director, Defense Research and Engineering, or their representatives.

All NIAG matters are routinely coordinated with the Assistant Secretary of Defense (International Security Affairs) and with the State Department and, depending on the subject, may be coordinated with other elements of DOD and other government agencies. Coordination is primarily of an informative nature, but the industrialists are apprised of U.S. Government policies or positions, as appropriate. Staff support for the U.S. delegation is provided by the offices of the Assistant Secretary of Defense (Installations and Logistics) and the Director, Defense Research and Engineering.

Moral Code

Since NIAG is unique, one of the first acts of the group was to adopt a moral code. Never before had industrialists of NATO countries gathered together in this kind of forum. It was, therefore, extremely important to develop a clear agreement of such things as organization, moral code and ethics, procedures, etc., but at the same time to remain sufficiently flexible to approach problems in a practical manner.

The moral code, on which there is unanimous agreement in principle, is:

> **The members of the NIAG are either representatives of industrial groups or even have direct interests in industrial enterprises themselves. This implies that conflicting interests might arise in the future, no doubt, when a start is made to work on the practical task of the NIAG. It is conceivable that information will be exchanged within the framework of the confidential projects to be discussed giving insight into the activities or interests of certain industries in particular countries. A free exchange of ideas can only take place if the members of the NIAG have the absolute certainty that nothing said within the four walls of the conference chamber could be used against them under existing conditions of competition. It is, of course, clear that no-one can be expected to forget what he has heard, but what one can expect is that all NIAG members, without exception, will have to adopt a very strict standpoint.**

Security

One of the most difficult procedural problems is dissemination of information, both classified and unclassified. The information developed during meetings comes out in the form of minutes or a "summary record." Information comes from the NATO Conference of National Armaments Directors and its four main groups. It will increase in quantity if the NIAG effort enjoys any degree of success.

In the case of the United States, summary records and NATO documents are automatically distributed to the members of the delegation, the four industry associations, the Departments of Defense and State, and any other interested government agency. Over 90 percent of this information is unclassified and can be disseminated to U.S. industry, as a whole, through various means.

A reliable means for releasing classified information to industry, as a whole, has not yet been worked out. NIAG recognized this as a severe problem at the outset and formed a subcommittee to study the matter. The committee concluded that "normal NATO security regulations" would prevail. To oversimplify, this means that it is the responsibility of each NATO nation to assure that NATO security information is not revealed to any national who does not have the "need to know" and the proper security clearance. The decision on who needs to know and who will make the decision is a sticky one.

NATO Member Countries

Belgium
Canada
Denmark
England
France
Greece
Holland
Iceland
Italy
Luxembourg
Norway
Portugal
Turkey
United States
West Germany

This question is being tackled by the delegation, industry associations and DOD on a priority basis.

Flow of Information

In addition to security information, the industrialists were interested in developing procedures to pass information between NIAG and the NATO Conference of National Armaments Directors (CNAD), particularly its four main groups. The industrialists felt strongly that, in order to be effective as advisors and consultants, there must be a "two-way street" flow of information. A special ad hoc committee, composed of one representative from each of the NIAG delegations and one government representative, was formed to make recommendations.

The ad hoc group decided that there were two types of information which NIAG will need from the CNAD Service Armaments Groups: background information and specific information. *Background information* will consist of current trends, threat analyses, likely weapon systems envisaged or desired countermeasures, and all other relevant aspects of the field of defense under consideration. *Specific information* will cover proposals made by countries or NATO military authorities, or suggestions arising from the examination of the replacement schedules for equipment requested by the NATO Conference of National Armaments Directors.

Procedurally, background information will be provided by means of presentations. Subjects for presentations may be selected from the following sources:

- Inventory of subjects currently under examination by the four CNAD main groups and their subordinate bodies, to be updated semiannually.
- Classified documents giving the status of discussion of items listed in the forementioned inventory, and also to be updated semiannually.
- Suggestions by the CNAD main groups and their subordinate bodies. A separate item will be included on each agenda for this purpose.
- Requests by NIAG.

Specific information on particular types of equipment will be transmitted to NIAG from the CNAD main groups by the most suitable means.

These conclusions and recommendations of the ad hoc committee on establishing a two-way flow of information were approved by the NATO Conference of National Armaments Directors in September 1969. The mechanics of making this agreement workable are being developed with difficulties still existing on both sides. From the standpoint of NIAG, finding an appropriate industrial expert to advise in given specific areas at a convenient time is not always easy. On the other hand, armament group members are understandably reluctant to "open up" in the presence of foreign industrialists without very clear authority from their own governments. The development of appropriate confidence in one another will take some time.

Other Items and Problems

In addition to the two areas discussed herein, there has been a considerable amount of discussion on general items that present common problems to both the industrialists and the government functionaries. Among others, these involve proprietary rights; common contractual clauses; balance of payments; requirements planning; studies on economic, financial and industrial factors which affect cooperation in research, development and production; data book relative to NATO member countries' military production and industrial capacity; quality assurance policy; a special planning fund; and a fund for feasibility studies.

It was to be expected that, when groups of senior industrialists and senior government officers representing several nations met, there would be many varied views. Each project is unique with each country participating, and so-called common problems will have to be tailored to fit the specific project. These matters have been discussed at length in plenary sessions and subcommittees have been formed to develop recommendations.

Joint Benefits Anticipated

It is not likely that immediate success in significantly increasing joint research, development and production will take place. However, there is optimism, for the long run, for success in these areas and, particularly, for greater standardization and interchangeability of components and parts.

It is the consensus of all who are involved in this effort that NIAG will play an effective role in the near future in:

- Increasing understanding of NATO and NATO country problems and requirements by NATO industrialists.
- Increasing acquaintances among companies of NATO countries.
- Making specific relationships and consortia among companies in NATO countries more possible.

It is important to reiterate that the NIAG delegations represent their industries as a whole. Furthermore, the U.S. delegation to NIAG does not necessarily represent the U.S. Government. Views may be expressed quite independently of the government's views. DOD officials, however, do act as a staff for the NIAG delegation and meet with them frequently in order to exchange opinions.

FY 1971 Defense Research, Development, Test and Evaluation Program

[Editor's Note: This portion of the *Defense Industry Bulletin* is devoted to a condensation of two statements before Senate committees by Dr. John S. Foster Jr., Director, Defense Research and Engineering, relating to the Defense Research, Development, Test and Evaluation Program.

The first is the Statement on the FY 1971 Defense Research, Development Test and Evaluation Program before the Senate Joint Committee on Armed Services and Defense Subcommittee of the Appropriations Committee, presented on Feb. 26, 1970.

The second is the Statement on Independent Research and Development before the Senate Ad Hoc Research and Development Subcommittee of the Committee on Armed Services, presented on March 13, 1970.]

I have given much thought to this opportunity to discuss with you the current and proposed research, development, test, and evaluation programs of the Defense Department.

My statement this year is different from those presented in the past. It is much shorter. I propose to discuss mainly the most essential issues and programs, the key matters that influence the country's defense research and development program. I will concentrate on the long range needs and not on the immediate programs. . . . Along the way, I will try to put these matters both in historical perspective and in a balanced national context.

To highlight the essential issues, I have condensed the basic case for defense research and development into four paragraphs. . . .

I believe that our life as a free and independent nation derives in large measure from the effectiveness of our defense establishment. At least since World War II, that effectiveness has derived fully as much from vigor of our national technology as from the numerical level of our forces. In fact, even when our forces were or could have been outnumbered in the past, they have been effective as a deterrent because of their technical quality. The quality of our advanced technology derives from:

- University research and teaching.
- Industrial research and development.
- DOD support of defense-related research and development, including in-house laboratories.
- Discussion of national security issues among informed, experienced, and independent individuals.

Our valuable technological superiority is today being challenged strongly from abroad. The most serious challenge comes from the Soviet Union, whose annual defense-related research and development investment caught up with ours a year or so ago and now substantially exceeds it. The effort of our national technical base is, in fact, declining while their effort continues to grow at a steady rate. I am deeply concerned about this trend.

We know that the two essential elements of our national security are: adequate force levels today and vigorous technological advances to ensure our future capability. The two essentials compete with each other, and with other national needs, for scarce funds. They can easily be confused by persons considering disarmament agreements in which it would be relatively easy to monitor force levels but almost impossible to regulate technology, especially where secrecy dominates a society. If force levels were to be controlled, we then would become especially sensitive to technological surprise. But advances in technology are essential if we are to limit, safely limit, force levels. Otherwise, we would not remain relatively secure against both surprise and possible non-adherence to an arms limitation agreement.

My conclusion is that to provide adequately for the common defense, we must ensure the continued vigor of our technology. To do this, we must ensure that the foundations of own technical strength—in universities, industry, and DOD research and development laboratories and centers—are not weakened or separated from our technological drive.

That, in brief, is our case.

Now I want to answer the critical questions: Why do we recommend certain programs? Why do we believe this overall recommended research and development effort is critical? What are we doing to improve our management? Why do we believe that this request is, as Secretary of Defense Laird put it, a rock-bottom budget?

* * * * *

Budget in Brief

For FY 1971 we are requesting $7,345.6 million in new obligational authority for research, development, test and evaluation (RDT&E). This is $881.8 million less than the $8,227.4 million requested for FY 1970. It is $23.2 million less than the amount actually appropriated for FY 1970. In terms of actual effort, considering the increased costs of research and development, the FY 1971 request represents a 4- to 7-percent *decrease* from the FY 1970 level.

This is, based on our best analysis and judgment, a rock-bottom budget. It was formulated in recognition of other urgent national needs which must be met by the Federal Government and in full consideration of the Administration's goal of stopping the inflationary trend in the economy. We believe this budget is "rock-bottom" for three basic reasons.

- We have reexamined the need for every major project, and are requesting the minimum funds necessary in FY 1971 to assure adequate strength for our future.
- All of the supporting projects, managerial functions and facilities have been pared and pruned. There is very little slack; and we have not even added funds to meet the increased costs which result from inflation.
- Finally, we have considered carefully the technological and military challenges which the nation faces, and we have concluded that a lesser program would not be prudent.

You, of course, will apply your own judgment to each of these programs. I believe a careful review will show delicate balance between assurance of sufficient funds to conduct the programs in a reasonable way and a danger that austere funding will lead to a high risk of program failure. To minimize the risks, we have cancelled a few programs rather than cripple many. Frankly, my personal judgment is that this budget is exceedingly tight, considering our probable future needs.

. . . Figure 1 (page 20) provides data [by mission objective, by category of research and development activity, and by category of research and development organization] comparing three fiscal years. The distributions reveal the necessary continued trend toward greater emphasis on our tactical forces—to meet known and potential threats and to fix deficiencies uncovered in Vietnam. . . .

The effective level of research *effort*, measured by funding in constant dollars, is decreasing—by about 12 percent between FY 1969 and FY 1970, and by 5 percent in FY 1971—a reflection of the roughly 5-percent annual increase in the national cost of doing research. The small increase in exploratory development for FY 1971 is designed to keep some of the key technical projects at a constant level of effort so that future developments will not have to be undertaken with substantial technical uncertainties. The requested funds for the categories of research and exploratory development will not support the level of work carried out in FY 1970. Thus, we will not be able to explore some promising technical opportunities relevant to defense, and we anticipate laying off technical personnel, closing certain laboratories, cutting out many contracts, and stopping projects.

The category of management and support shows a small decrease in funding between FY 1971 and FY 1970. Thus, we will not keep up with increased costs, and will be forced to reduce or eliminate some supporting functions.

The large increases in advanced development and engineering development—including increased funding for the F–15 and S–3A aircraft—are compensated for in part by a large decrease in operational systems development, including decreased funding for the F–14, Minuteman, and Poseidon and the elimination of the MOL program. . . .

Highlights of FY 1971

I will review now the highlights of our planned research and development programs for FY 1971 which are related to strategic forces, tactical forces, electronics and information systems, and to the research and technology base. . . .

Strategic Forces. I would like to introduce the subject of research and development related to our strategic forces by reviewing the progress we have made in the last year on the newest development activities for the strategic missile force—Poseidon and Minuteman III. Both of these programs are in the flight-test phase with 15 to 20 flight tests completed on each system. . . . The success ratio of about 70 percent is high for this stage of development testing. . . .

. . . The threat to our strategic forces is the number of large Soviet SS–9 ICBMs equipped with three multimegaton warheads and the larger number of SS–11 ICBMs carrying a single warhead. As of February 1970, the Soviets are believed to have over 275 SS–9s under construction or operational and over 800 SS–11s.

At present construction rates, four years from now—in early 1974, which is the earliest any of the alternates to assure Minuteman survival could begin to be operational—the Soviets could have several hundred additional ICBMs, could be deploying multiple reliable and accurate reentry vehicles in each SS–9, and could have improved the accuracy of the SS–11. This would be more than enough to overwhelm the present Minuteman portion of our deterrent. . . .

We do not know whether or when the Soviets will stop or reduce the rate of development and deployment of their ICBMs. Therefore, we must act now to maintain the land-based missile force deterrent. We have long followed a policy of maintaining three independent deterrent forces, any one of which should be sufficient to deter nuclear attacks on us. To maintain this cornerstone national security policy, we cannot defer corrective actions.

Safeguard is a major step to improve the survivability of an adequate fraction of our land-based missile forces.

The Safeguard objectives, as stated last year by President Nixon, are: to protect our population against limited attacks from the Chinese as well as from accidental attacks from any source; and to assure the survival of a sufficient level of our land-based strategic forces against an attack by the Soviet Union. The President also required an annual review of technical developments, the potential threat, and the diplomatic context of Safeguard.

This review has been completed. Technical progress on Safeguard this past year has been satisfactory. Meanwhile, as I have said, the offensive capability of the Soviet Union is increasing. Their forces could, in the mid-1970s, threaten almost all of our Minuteman and bomber forces. The Chinese are continuing with their nuclear program and could have operational ICBMs by the mid-1970s.

On the basis of these considerations, the President decided to request authority and funds to begin phase II of Safeguard in FY 1971. We are requesting authorization in FY 1971 to add one more Safeguard battery, in the Minuteman missile field at Whiteman AFB, Mo., and to begin advanced preparation for five more sites. . . . The deployment at Whiteman will contribute to coverage over the central United States as a part of a defense of our bomber bases against Soviet submarine-launched ballistic missile (SLBM) attacks and of a light area defense of the entire U.S. population against possible Chinese attack. This action also will provide additional protection for elements of our Minuteman force against possible Soviet attack.

If the Soviet forces continue to grow, Minuteman defense may not be economical with a system using only Safeguard radars. The cost of the existing missile site radar (MSR) makes this solution unattractive. Accordingly, the Army Ballistic Missile Defense Agency has started the development of a smaller radar which could be dedicated to hard-point defense. This radar should cost less than the present MSR which would

Estimated Distribution of DOD RDT&E

(Total Obligational Authority—Dollars in Millions)

	FY 1969		FY 1970		FY 1971	
	Dollars	Percent	Dollars	Percent	Dollars	Percent
MISSION DISTRIBUTION						
Strategic	3,000.3	38.7	2,504.3	33.6	2,312.2	31.5
Tactical	2,258.9	29.1	2,451.2	32.9	2,600.8	35.4
Other Mission Research and Development	1,101.4	14.2	1,081.4	14.6	1,033.5	14.0
Technology Base	610.0	7.9	562.4	7.6	595.0	8.1
Support	785.1	10.1	764.6	10.3	754.1	10.3
Emergency Fund	—	—	75.0	1.0	50.0	.7
TOTAL	7,755.7	100.0	7,438.9	100.0	7,345.6	100.0
DEVELOPMENT DISTRIBUTION						
Research	404.2	5.2	368.5	5.0	369.6	5.0
Exploratory Development	875.1	11.3	857.0	11.5	897.4	12.2
Advanced Development	964.5	12.5	938.7	12.6	1,112.7	15.3
Engineering Development	800.4	10.3	1,021.8	13.7	1,395.9	18.9
Management & Support	1,226.9	15.8	1,205.0	16.2	1,167.5	15.9
Emergency Fund	—	—	75.0	1.0	50.0	.7
Operational Systems Development	3,484.6	44.9	2,972.9	40.0	2,352.5	32.0
TOTAL	7,755.7	100.0	7,438.9	100.0	7,345.6	100.0
PERFORMER DISTRIBUTION						
Industry	4,914.2	63.4	4,551.6	61.2	4,535.2	61.7
Government In-House	2,359.9	30.4	2,369.1	31.8	2,316.9	31.5
Federal Contract Research Centers	231.1	3.0	216.4	2.9	224.9	3.1
Universities	241.3	3.1	223.1	3.0	215.6	2.9
Foreign Performers [1]	9.2	.1	3.7	.1	3.0	.1
Emergency Fund	—	—	75.0	1.0	50.0	.7
TOTAL	7,755.7	100.0	7,438.9	100.0	7,345.6	100.0

[1] Includes only Research and Exploratory Development Categories.

Figure 1.

allow us to increase, if necessary, the number of radars within the Minuteman wings.

There are other ways to meet a growing Soviet ICBM threat to Minuteman: First, relocation of some of the Minuteman missiles from their present soil silos to more survivable "hard-rock" silos designed to provide much greater hardness; and, second, mobile basing of the Minuteman force into a new basing configuration such as "shelter-basing." In the "shelter-based deployment," the missiles would be located on truck-type transporters, each of which could go on warning into any one of several dispersed and hardened shelters. Such a technique increases survivability by making Soviet targeting uncertain.

Each of these options has its advantages and disadvantages. The hard-rock-silo deployment places a significant additional burden on the attacker because greater accuracy or yield, or both, is required to destroy the target. The main disadvantage is that its improved survivability can be entirely offset by sufficient improvement in the attacking missiles. The current understanding of mobile basing schemes is simply not adequate to permit a recommendation now on deployment. However, studies on these options will be completed by the end of FY 1970 and should lead to a recommendation for our FY 1971 program. Funds have been requested for this purpose.

We are not sure that the problems of land-based missile survivability can be solved permanently. In the unfortunate case they cannot, a backup is to place greater emphasis and dependence on our sea-based missile forces, now consisting of Polaris and Poseidon. The undersea long range missile system (ULMS) is our basic new program to assure a sea-based force upon which we can rely in the future.

The ULMS submarine would deploy an ICBM range missile, thus expanding by a factor of 10 to 15 the operating area as compared to that of Polaris. This would greatly complicate any Soviet effort to destroy our SLBMs. The new submarine would be quieter, optimized for its role, and would operate from ports in the Continental United States, thus eliminating any dependence on foreign bases. ULMS also would provide for the orderly replacement of the present nuclear-powered submarines (SSBNs) at the end of their operating life. We are examining this concept very carefully. With the funds we are requesting for FY 1971, a deployment decision could be made in the early 1970s.

We continue to have confidence that the backbone of our bomber force—the B–52—is effective today. However, the Soviets might be able to blunt the deterrent value of this force. One option might be to employ a portion of their growing SLBM force to reduce our warning time to just a few minutes. Another Soviet option would be to improve their air defense: by deploying an airborne warning control system to direct their high speed interceptor aircraft to engage our bombers before they penetrated Soviet territory, and by improving their terminal defense against low altitude aircraft.

For these reasons, we are moving toward engineering development on a new strategic bomber, the B–1, which could be operational in late 1977 or 1978 should circumstances warrant deployment. It would function even under reduced warning times through a combination of shortened scramble time, dispersed basing, and possibly airborne alert. In addition, we will deploy a surveillance satellite which will provide warning for our bombers that an attack is forthcoming. This would give the bomber force increased time to scramble. Improved Soviet defenses would be countered by stand off air-to-surface armed decoys and missiles—subsonic cruise armed decoy (SCAD) and short-range attack missile (SRAM)—as needed to augment the increased penetration capabilities inherent in the B–1's design.

In summary, then, all of our major strategic programs are designed to maintain an effective nuclear deterrent. Our major strategic forces must be capable of surviving a Soviet attack if they are to continue to provide a credible deterrent. And major restructuring of the strategic forces may be necessary to ensure survivability, if the Soviet threat continues to grow along present trends. Substantial progress in Strategic Arms Limitation Talks would, of course, help to keep the problems within reasonable bounds.

Tactical Warfare Programs. In general, the RDT&E effort to improve our tactical forces continues to increase—both in absolute terms and as a percentage of the overall research and development—as we provide systems needed to counter known and potential threats in the air and at sea, and as we fix deficiencies revealed in Vietnam.

Major changes have been introduced in the management of tactical warfare programs. Program management has been decentralized, and organizational changes have been made to emphasize the achievement of mission capabilities on a multi-service basis. . . . OSD will concentrate on the research and development needs in the basic long range tactical missions: land warfare, ocean control, air interdiction warfare and combat support.

Land warfare, which embraces all aspects of close combat, fire support, field Army air defense and battlefield surveillance, is undergoing major change. The most significant development activity in the area of close combat is aimed at overcoming the numerical superiority possessed by the tank forces of the Warsaw Pact nations. A major element of our effort in this regard is the main battle tank (MBT–70) program, which has now been reoriented to provide a single U.S. manager with development authority and responsibility and to reduce production cost by more than $200,000 per tank. Another particularly critical problem in the area of close combat is that posed by the mine and booby-trap threat in Southeast Asia which now accounts for a substantial portion of our casualties. Some progress is being made, although this threat unfortunately strains the technology now available to us.

In the area of fire support, technical problems with the Lance missile have largely been resolved; the management of the AH–56A Cheyenne is being revised to permit a more aggressive engineering effort; and a prototype competition for our first optimized close-support aircraft in over 20 years is planned to start late in FY 1970. With regard to field Army air defense, our deficiencies in low-altitude protection are beginning to be filled as the Redeye, Chaparral and Vulcan missiles are deployed, and our major RDT&E efforts thus are being shifted to the SAM–D system. SAM–D is intended to ensure that modern countermeasures technology will not be able to negate our air defenses in the way we were able to overcome the Soviet-developed surface-to-air missiles deployed in North Vietnam. Lastly, in the area of battlefield surveillance, we are concentrating on exploiting the remote sensor developments of the war in Southeast Asia to give us an altogether new combat capability based on the concept of an "instrumented battlefield."

Ocean control embraces fleet offensive operations, fleet air defense, antisubmarine warfare/submarine warfare and ocean surveillance. In fleet offensive operations, an improvement in our shipboard gun and missile capabilities is needed to meet the Soviet naval threat. Our major research and development effort in this area centers on the development of Harpoon, a standoff antiship missile system capable of being launched from surface as well as airborne platforms.

The Soviet antiship missile threat remains a major concern. Major efforts related to our surface ships are: development of the Aegis (formerly ASMS) missile system and the Phalanx high-rate-of-fire gun system, which provides close-in backup defense against attacks which might penetrate the longer range defenses.

The Soviets' submarine force capabilities have increased at a rate that exceeds our prior estimates. Our antisubmarine warfare research and development programs must continue with vigor and imagination if we are to maintain the capability to counter the Soviet submarine force. Among the more important programs started in FY 1970 are the S–3A, the SSN–688 and the DD–963. We are carefully examining new technical alternatives as they develop.

Ocean surveillance programs planned for FY 1971 include an improved information processing system and the investigation of other concepts.

The air interdiction mission embraces the counterair, defense-suppression deep strike, and tactical reconnaissance roles. Within these areas, recent actions on the Air Force F–15 and the Navy F–14 air superiority fighters will have a major impact on future U.S. air warfare capabilities and are reflected in the FY 1971 budget request. The F–15 program will incorporate advances in engine, avionics, weapon (short-range missile), and materials and structures technologies in an effort to provide an aircraft system superior to the Soviet fighters of the mid-1970s. A cost-reimbursable development program with clear-cut technical achievement milestones has been issued, to be followed by a fixed-price production program. With regard to the air-to-air short-range missile, we are structuring our program to provide a common missile for Navy and Air Force use.

The Navy's fleet air defense needs (combat air patrol—CAP) will be fulfilled by the F–14A and its long-range Phoenix missile system. The subsequent F–14B/C systems, equipped with an advanced engine, will provide major improvement in the Navy's fleet defense and air superiority capabilities through improved propulsion and new avionics.

A combination of weapons, tactics and electronic countermeasures is employed for suppression of enemy air defense weapons. A major system for defense suppression is the EA–6B, which has successfully passed the "fly-before-buy" test, and is now authorized for production. Continued research and development effort is planned for the EA–6B to meet new and changing threats in the electronic countermeasures environment. Efforts are also under way to find lower cost alternatives to the Standard ARM (antiradiation missile).

The F–111 squadrons and the A–6E provide the deep strike capability. Development on these systems is essentially completed, except for continued testing and supporting technical work. The cost of deep strike missions is being subjected to careful examination. An attempt is being made to reduce the number of air munitions, both to reduce the logistic burden and to find lower cost alternatives to weapons such as Condor. In general, our basic requirement is to reduce the cost to kill a given target and, thus, we face a number of tradeoffs.

Combat support embraces tactical air command and control, logistics, training and operational support. The immediate goal of tactical control is to exchange tactical information and orders among surface and airborne fleet units (NTDS/ATDS), the Marine air control system (MTDS), the Air Force tactical control system (407L), and the Army air defense and missile control system (TSQ–73). A longer term objective is to make these systems responsive to various concepts of operations, and to ensure that future systems are compatible with those now in the inventory. We are improving airborne tactical control for the Navy and Air Force through the E–2C and airborne warning and control system (AWACS) programs. . . . The E–2C is essentially an improved version of the E–2A/B system with increased reliability and a redesigned radar which was extensively tested prior to initiating the E–2C development/production program.

In the logistics area both STOL and V/STOL concepts are being considered for the light intratheater transport (LIT) to bridge the logistics gap between intertheater transport systems and combat troops.

Electronics and Information Systems. The dramatic advances being made in electronics technology give us

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a major opportunity to improve the efficiency and overall effectiveness of all of our strategic and tactical forces. With new sensors, avionics packages, electromagnetic countermeasures, and point-to-point communications, our mobile platforms and tactical units can become more versatile without getting completely new families of major weapon systems.

New techniques and devices are being developed to provide increased capability in sensing signals and viewing operations, in processing signals and data, in transmitting information at higher speeds with greater accuracy, and adding needed automation and security to communications. Each few years often sees a tenfold improvement in these capabilities. Flexibility of installation and operation and increased survivability will also be realized. New equipment will be considerably smaller in size, lighter in weight, more reliable, more easily maintained and, in some cases, less expensive. Greater power output will be possible with reduced power consumption.

We hope that these advances will lead to the following new and needed functions:

- Permit the wider use of surveillance and target acquisition devices and provide a new capability to employ troops and firepower at night.
- Assist existing aircraft, ships and tanks to intercept, exploit, evade and/or counter enemy electromagnetic emitters.
- Provide the basis for the development of standard equipments that can be used in a much wider variety of applications and platforms.
- Greatly improve navigation and position fixing in a worldwide common grid system.
- Increase communications satellite channel capacity from 5-10 channels to some 1,200 channels, thus interconnecting hundreds of widely dispersed users in a timely and flexible manner and permitting transmission of wideband secure information over long distances.
- Permit the development of ultrareliable equipment and systems (thousands vs. hundreds of hours between failures) that will drastically reduce supporting logistics costs (maintenance personnel, spare parts inventory, training) and increase operational availability.
- Reduce the number of people overseas operating intelligence collection systems, thus reducing gold flow as well as certain risks in intelligence collection.

Research and Technology Base. I must emphasize the fundamental point of justification for the relatively basic and applied research work within the overall research and development program. To maintain strength and avoid surprise, we must know what developments in weapons are possible and practical, for ourselves and for potential enemies. We cannot afford to be the nation surprised in critical areas having long lead times for understanding as well as for development. For this reason, we have chosen deliberately, in a very tight budget, to maintain our efforts in the relevant research and exploratory development.

Defense research and exploratory development are directed dually at targets of opportunity and at identified needs. The goals are to fulfill recognized requirements in military technology and to make possible new and superior technology through the exploitation of new technical opportunities. To meet these goals requires research in the physical and mathematical sciences, the chemical and engineering sciences (electronics, materials, mechanics, and energy conversion), the environmental sciences (terrestrial, oceanographic, atmospheric, space), the biological and medical sciences, and the behavioral sciences. New and improved technological capabilities are extremely valuable in military functions, such as communication; surveillance and tracking; navigation; remote control of weapons; firepower; mobility of weapons and personnel on the ground, sea, and air; training and support of personnel; propulsion of craft and of weapons.

Section 203 of the FY 1970 Military Procurement Act was designed to ensure that public funds provided for military research and development are utilized only for projects related to specific military functions. It is important that its provisions not be interpreted so as to threaten further reduction or expulsion of DOD support for basic research, in general, and the university research community, in particular. Such a consequence would cripple defense research and technology, especially our ability to respond rapidly in time of national crisis. We must maintain a high level of imaginative technical effort in most, if not all, of the fields related to long term national security needs. Equally important, disconnecting the defense research and development program from the academic research community would deny to national defense discussions with some of the most outstanding and willing scientific and engineering talent of the country.

In the context of the changing environment we face in the 1970s, all of us must recognize that our vital base of research and technology has been declining since 1966. The overall decline in actual technical effort, *i.e.*, considering the increase in costs, has been roughly 30 percent in the past five years.

Further erosion of this base will expose the nation to the technologically based threats of the 1970s and 1980s, protected only by the technology of the 1960s. Because of this danger, I urgently request you to support this part of our request for FY 1971 in particular.

Some Fundamental Issues

Some people today seem to think that defense research and development does more harm than good. They ask: Aren't you building weapons that do not increase security but rather decrease security and increase the taxpayer's burden? Others have a "gut feeling" that new technology, all new technology, causes more problems than it solves, and that because scientists seem oblivious to the terrible social and economic costs of their triumphs, their work must be controlled by curtailing their financial support.

Most Americans do not agree, of course, but this controversy can threaten the nation's entire research and development base. It has the most profound implications for our future national security. We must talk soberly about it.

Need for Defense Research and Development in a Changing Military Environment. It seems reasonably clear that the decade of the 1960s, and particularly the late 1960s, was a turning point for the military establishment in the United States. We have been through a quarter-century of war and near-war, and during most of this period our defense needs have been awarded essentially an overriding priority. But today, as a writer in the January issue of *Foreign Affairs* put it: "Not since World War II have Americans been so uncertain about the proper role of the United States in the world."

Much of the change in the last few years has been directly concerned with the broader implications of the Vietnamese war and America's other involvements abroad. Many persons are skeptical, even hostile, about the competence, judgment, and goals of the defense establishment and foreign policy. They see no serious near-term military threat.

There is another tendency in public discussions of the Defense Department today: blaming the industrial sector for wars. This outlook characterizes the United States as inherently imperialistic and exploitative, and pins the responsibility for this defect on the "military-industrial complex" and on the political establishment as the agents of the repressive forces inherent in our structure.

Whatever weight we may assign to these beliefs, and whatever we believe individually about their validity, they do contribute to a changing political climate in this country. Thus, a new series of issues is raised. The new climate and these new issues will affect our future national security, in part by affecting the resources assigned to defense research and development and, in part, by affecting the flexibility of defense management in general. That is why I believe we must examine them.

The most fundamental issue rests upon the judgments we must make about the relationship between our capabilities and probability of serious aggression or threats hurting the interest of the United States or the interests of our friends and allies.

Consider the tension in Europe of the late 1940s, the Korean War, the Russian interventions in Eastern Europe in the late 1950s, the Cuban missile crisis, the invasion of Czechoslovakia, and the current Soviet activity in the Mediterranean. All of these threats and potential threats to American interests are impressive evidence that the Soviet leaders remain prepared to act or threaten to act militarily, with major international consequences, whenever their perception of the political-military situation suggests to them that such action is in their interest and feasible. How many more such threats and actions might we have seen had we not possessed technologically advanced capabilities? Clearly, although we are moving into an "era of negotiation," trying to shore up and broaden the emerging détente, we must remain prepared for possible confrontations.

Because of the overriding significance of strategic stability during this nuclear era, past and future, the United States has emphasized strategic nuclear deterrence. Successful deterrence requires advanced technology to ensure that our retaliatory threat continues to be credible. Further, we have required general purpose forces for those missions necessary to support our security commitments and our allies. These missions also require, in some cases, sophisticated technology for a variety of combat and support functions.

There seem to me to be two central lessons in the history of national defense needs and threats since World War II. First, as the Durants said in reviewing *The Lessons of History*: "Peace is an unstable equilibrium, which can be preserved only by acknowledged supremacy or equal power." While we must take certain risks to achieve secure and lasting peace, too many risks taken in the interests of peace can at some point become in themselves the threat to peace.

Secondly, we see even greater evidence today that research and development are essential to a prudent national security effort. The reasons for this are essentially the same as in the past, but they require special emphasis today. Let me reiterate these reasons as you consider the budget request.

First of all, research and development provide a qualitative advantage required to compensate for any numerical inferiority which the United States has or might suffer in troops or equipment and for any temporary disadvantage we might suffer should a numerically superior force take the initiative. If we maintain our technical leadership, we can achieve our goals—sometimes at lower operating costs—without necessarily competing with the Soviet Union in total numbers of missiles or bombers or troops. Thus, the quality of our deterrent may be more critical than the quantity of our deterrent—and without research and development you cannot have this quality: You would not have it now, and you will not have it in the future.

The second general argument for defense research and development is that knowledge creates options which the President *may* need during a period of tension, or during planning, or during negotiations. It is much safer to know what might be feasible in weapons than to have to guess about what a potential enemy is capable of doing. This "option-creating" function is important also because it permits the Defense Department to respond more rapidly and effectively to large changes in national security policy where such changes are caused by increased tension or decreased tension. We can be prepared to substitute new equipment for old if this improves the effectiveness of our forces, or would improve the effectiveness of an arms control agreement.

The third general justification for defense research and development is that the nation needs as broad as possible a conceptual basis for arms control negotiations, for war, or for a provoked, renewed arms race. We need to act intelligently on national security, including arms control, by considering the broadest possible range of technological possibilities.

My point here is a direct one. To cut the research and development program today is, in effect, to claim great precision in a prediction of the nature of the world in 5 to 20 years and to foreclose on the option of our future leaders who will have the responsibility for our national security at that time. Certainly, let us try hard to cut the costs of the overall defense burden and to negotiate acceptable treaties limiting weapons. But let us not mortgage the future by dismissing or misjudging the critical

—and growing—need for defense research and development.

National and International Significance of Strong Research and Development Activities. Now I want to discuss the significance, on a comparative basis, of our overall national and international technical position. Closely related are the policies affecting the way in which defense research and development interacts with the rest of the national technical base.

Let us begin with obvious questions. What is the national technical community, the "national technical base," that research and development managers talk about? Why is the base important—to national security and other national goals?

Normally the national technical base is assumed to be the sum total of all of the research and development completed and being carried out in the country. Expressed in funds, this is about $27 billion in FY 1970,[1] roughly 55 percent of federal funds and 45 percent of non-federal funds (which includes independent support from corporate, foundation, and university groups as well as funding from state and local governments). Expressed in technical manpower, this represents about 800,000 professional scientists and engineers and 850,000 supporting technical people. Now we should see what this means.

The following data help to put the U.S. technical manpower base in perspective with respect to the Soviet Union, the only other nation now comparable to the United States in technical strength:

Annual College Graduates
(Thousands)

	1955	1960	1965	1970 (est.)
USSR				
Engineers	67	102	176	240
Scientists	23	33	33	35
Nontechnical	179	192	222	305
Total Soviet	269	327	431	580
U.S.				
Engineers	26	31	36	45
Scientists	22	43	68	71
Nontechnical	255	305	436	664
Total U.S.	303	379	540	780

It is helpful to project current trends forward in time, based on rough estimates, to appreciate the cumulative impact of continued growth rates in Soviet research and development manpower:

Total Full-Time Research and Development Scientists and Engineers
(Thousands)

	1969	1971	1985 (est.)
USSR	550	610	800
U.S.	540	570	600

These manpower data show an impressive Soviet commitment to the training of engineers—and, overall, a strong Soviet effort in all technical manpower fields—compared to the United States. It should be pointed out, however, that some Soviet engineers are actually engaged in nontechnical tasks, as well as in tasks that in the United States are adequately performed by technicians and foremen rather than engineers. Therefore, although I am not inclined to believe that there is much difference in the overall quality of training for comparable technical categories between the United States and the USSR, the United States does appear to use its technical manpower more effectively.

Comparative funding data for research and development in the United States and the USSR—data that are probably accurate within about 10 to 20 percent—look like this:

Research and Development Funding
(Billion 1966 dollars)

	1955	1960	1965	1968	1970 (est.)
USSR	3.5	7.8	13.9	17.7	21.3
U.S.	5.1	13.7	20.6	25.4	24.6

Three points drawn from RDT&E funding data should be examined seriously. First, total Soviet research and development has been growing faster during the past decade than total U.S. research and development. For example, the U.S. total funding was almost twice that of Soviet total in 1960, and by 1970 the U.S. total was only about 15 percent greater. During the last few years, Soviet research and development has been growing by roughly 10 percent per year while U.S. research and development effort has essentially leveled off. For the entire decade of the 1960s, Soviet research and development devoted to military, atomic energy, and space applications grew by about 13 percent per year, and this vigorous growth rate appears to be continuing. These budget data have been found to be consistent, on a general program basis, with the resources required to support the growing numbers and types of aircraft, missiles, ships and other equipment which the USSR has been developing in recent years.

Second, the USSR continues to emphasize military/space/atomic energy research and development. For example, looking at the military component alone, during the 1960s the Soviet military research and development increased by about 60 percent while the U.S. military research and development increased by roughly 30 percent. Overall, Soviet funding for military/space/atomic energy research and development is now about $16 to $17 billion while comparable U.S. funding is about $13 to $14 billion. In the last two years, however, the USSR has shown considerable concern over the lagging technological level of its civil industrial base and appears to be adding resources to this sector, but not at the expense of continued growth in their defense, space, and atomic energy efforts.

Third, we should note that cumulatively and currently, the United States has a substantially larger investment in research and development than the USSR. During 1960–68, U.S. research and development amounted to about $173 billion, while Soviet expenditures were somewhat more than 50 percent of that. Nevertheless, the U.S. activity is much more heavily weighted toward civil research and development (in 1968, roughly $11 billion out of $25 billion total) compared with the Soviet proportion on civil research and development.

Let me raise one final point regarding the overall U.S. technical base. Recent analyses by the Commerce Department staff have suggested that an important reason for our country's balance of payments problems and for our industry's competitive marketing difficulties abroad is that the United States no longer has a predominant position in "technically intensive products."

Many foreign countries are driving hard toward "technological parity" with the United States and, in some important cases, have already surpassed us. Japan, for example, relying upon a labor force one-half as large and not quite as well educated as that of the United States, is advancing almost spectacularly across almost the whole spectrum of advanced technology. Japan's growth rate in technologically intensive manufactured products was 22.5 percent per year during 1955–65, compared with the United States at 3.9 percent per year and West Germany at 8.4 percent per year.

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[1] *"National Patterns of R&D Resources, 1953–70," National Science Foundation, NSF 69–30, dated September 1969, page 14.*

The latter data and perspectives are largely concerned with civilian high technology activity rather than with exclusively military activity. Nevertheless, it would be superficial and perhaps hazardous not to assume that, when other nations' capabilities for advanced technology are already strong and growing rapidly, this has some significance for our long term national security.

In general, then, I urge you to consider the broad pattern of our national technical base. Examine not only the merits of the individual research and development efforts of all Federal agencies, but also keep in mind our country's overall comparative international position. After reviewing this situation myself, my judgment is that the United States must move toward a much more vigorous commitment to national research and development, both military and civilian-oriented, upon which our long term national technological position can be strengthened.

There are two other points I want to touch on briefly regarding the way in which defense research and development fits into the national technical activity.

First, some observers have asked: Why does every agency support its own research and development activity? Doesn't this lead to overlapping and duplicating work? The answer is straightforward.

For an agency to improve its effectiveness in fulfilling its mission, it must experiment with new approaches and evaluate them against existing methods. Research and development provides tools used to achieve our objectives. Research and development, thus, cannot be conducted effectively unless it is coupled as tightly as practical to the organization responsible for attaining the objective. In the last few years, this has been proved again and again as the newer civilian agencies have discovered the needs for—and the power of—serious research and development efforts. Further, for the national research and development base to be healthy in the long term, each agency's research and development program should include some relatively basic research—to deepen our understanding of fundamental problems. In addition, an organization such as the National Science Foundation must assess the national scientific base and support many key projects itself, including some designed to fill in the gaps left by the mission agencies' technical priorities, so that the country has an adequate and balanced total scientific effort. This overall federal pattern—"pluralistic" support of research—includes little or no unnecessary duplication—and the crucial reason is that no scientist or engineer wants to duplicate another investigator's work unless he has a very good purpose.

A second issue raised by many in Congress is: Why aren't there better measures to gauge the need for research and development and better measures of the quality and the payoffs of the research and development being supported? Frankly, we share this impatience, but no one can know what fruits our labor will produce—that's why we labor.

As I will discuss later, we are working hard on many improvements in research and development management. But especially for basic and applied research, I will be candid: There is no valid "formula" that demonstrates how much is enough, how well the work is performed, and how much work in each technical field is optimum. Within DOD we depend upon the judgments of competent scientists and officers in the military research and development community, tempered by technical reviews in my office and subjected to the criticism of experts from industry, universities, and the Federal Contract Research Centers. We are prepared to justify each project in terms of quality, relevance, and cost—and to discuss the many payoffs achieved from past research. We are studying a number of new resource allocation procedures and program evaluation methods. Nevertheless, at this point no one has a comprehensive and quantitative management "system" for research.

What I have said so far can be summarized in two points. First, our past national position of technological leadership is being eroded and is being challenged seriously by both our friends and our potential enemies. I am deeply concerned about this trend for national security. Second, the federal research and development management is strongly aware of its responsibilities to avoid any unnecessary work during this period of tight national budgets and fierce international technological competition. We believe we are making every research and development investment count to our advantage.

Issues Affecting Defense Research and Development. Two current criticisms of all research and development—insufficient concern with the consequences of using new technology, and excessive federal support of research and development—have, of course, been focused on the Defense Department. I think we should discuss them forthrightly.

Some have argued that, because other national needs should be assigned a higher priority in the future, defense research and development has therefore become less important than the research and development related to other national needs. Some critics add that the Defense Department has dominated university research for too long and that this situation should be changed. Let me give you the facts.

To begin with, over the last 30 years the Defense Department's share of the national research and development activity has declined significantly. In the late 1940s, most of the federal support of the nation's research and development was provided through the Defense Department. Today, the situation is quite different:

- More than half of the total Federal expenditures for research and development (about $8.2 billion out of $16 billion) is provided by civilian agencies[2].
- Almost 75 percent of the total

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[2] *Special Analysis Q, "Federal Research, Development, and Related Programs," Bureau of the Budget, February 1970, p. 266.*

national expenditures for research and development (about $20 billion out of $27 billion) is provided by civilian federal agencies and independent (*e.g.*, industrial) organizations.[3]

- More than 85 percent of the federal support for academic research and development (about $1.3 billion out of about $1.5 billion) is provided by civilian agencies[4].

These facts squelch the popular assertion of "Defense Department dominance." And they make it clear that the nation's many growing needs for civilian technology are already reflected in the changing national pattern of research and development. Although I am concerned that the level of defense research and development may be too low, I support the further growth of civilian research and development.

Another often discussed criticism of defense research and development is that it inevitably and uncontrollably feeds the arms race. The notion is that technology once shown feasible will inevitably be developed into full-scale hardware, that the hardware once demonstrated will be bought in quantity, and that the hardware once deployed will lead to counterdeployments by our potential enemies—thus, that arms procurement accelerates while real national security deteriorates.

This is a gross caricature of fact. There is no social institution or human activity which cannot be used for good or evil, peace or war, for attack or for defense. Technology may be used in either arms race or arms control. It is much less the state of technology and much more the state of world politics which determines the use of technology in international affairs. Yet whatever the political-military environment, the modern nation which turns its back on technology is doomed to a second-class existence. I can specifically relate military technology to the arms race by two threads of rational argument.

First, first-class, defense-relevant science and technology slows the arms race. For example, it preserves our security by decreasing the possibility of a technological surprise which could destabilize world security balances. No one wishes to have a "Sputnik," and a 10-year catch-up period in national security. Further, defense research and development helps to make arms control agreements possible by decreasing the risks should such arms control treaties be broken. No one wishes to have a Pearl Harbor after a major arms control agreement. And by providing options for qualitative improvements, research and development often enables us to avoid the need for large increases in the size of our forces. Finally, defense research and development serves as a general "safety device" and "insurance" in that it permits technical experts to understand and apply facts and judgments to defense decisions. Just as no one wishes to have our troops, if and when called to combat, equipped inadequately, no one wishes to have the technological aspects of an actual or potential threat analyzed by persons who do not have access to first-class technical knowledge.

Second, it is a combination of civilian leadership and public control that makes the decisions about the application of available technology. Decisions about every major procurement are subject to intense reviews by the Secretary of Defense, by the President and by the Congress. In these reviews, we are deeply concerned about the possible consequences of using new technology. We do separate clearly the issues of whether-to-research-and-develop from whether-to-deploy. We do question the need, the real and potential threat, the costs. Many possible systems are rejected for many different kinds of reasons. For example, the President's recent decisions on chemical weapons, biological weapons, and toxins show our willingness not to pursue some lines of research and development and to accept some military risks when this appears to be in the country's broader interests. Because of the open debates, and because of civilian leadership at all critical decision points, there is no necessary or inevitable connection between the availability of technology and the promotion of the "arms race."

For these reasons, defense research and development is a "hedge" against the unknown and is a reservoir of concepts and talent required to ensure our security. There is no "mad momentum" inherent in this outlook.

Improvements in Management

Every year for many years, senior officials in DOD have explained not only the achievements of research and development, but also the problems in research and development management and our efforts to solve them more efficiently. The main reason this subject has received so much high level attention is that it is in many respects our most important and most difficult task.

Critical Need. Today, the need for better research and development management is even more critical. We expect to restore the confidence of the Congress and the nation in DOD management through convincing actions and, thereby, earn the respect necessary to forestall reductions in funds that might well threaten our future security.

All of you know that developing new systems is inherently risky. You know that even if management were perfect, unpredictable factors always emerge, such as changes in threat, changes and surprises in technology, unpredictable engineering problems, the opportunity for further improvements in capability, inflation of the economy, and changing national priorities. You also recognize that, if the country is to be prepared for a possible threat in 1975 or 1980 or 1985, we must start now. This means trying to predict the shape of a possible enemy's forces and technology—through a curtain of secrecy—and being able to cope with them for up to two decades into the future. In formulating and carrying out programs, we must make all of the difficult judgments about all these factors far in advance.

You have heard all of this before. And you have heard what I believe was sincere testimony discussing the actions intended to improve management in this complicated environment. Some significant advances in efficiency and control were made in the past. But that testimony, those actions, and those advances were not enough. Costs have continued to grow. Some

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[3] *Ibid, and "National Patterns of R&D Resources, 1953–70," NSF 69–30, p. 14.*

[4] *Ibid, p. 257.*

RESPONSIBILITIES OF SECDEF AND SERVICE

	CONCEPTUAL PHASE	PROGRAM DECISION	VALIDATION PHASE	RATIFICATION DECISION	FULL-SCALE DEVELOPMENT	PRODUCTION DECISION	PRODUCTION	DEPLOYMENT
SECDEF	X	●	X	●	X	●	X	X
SERVICE	●		●		●		●	●

RESPONSIBILITIES WITHIN OSD

	CONCEPTUAL PHASE	PROGRAM DECISION	VALIDATION PHASE	RATIFICATION DECISION	FULL-SCALE DEVELOPMENT	PRODUCTION DECISION	PRODUCTION	DEPLOYMENT
SEC DEF		●		●		●		
DDR&E	◑	◑	◑	◑	◑	○	◑	
ASD (I&L)		○		○		◑	◑	◑
ASD (C)	X	○	X	○	X	○	X	X
ASD (SA)	X	○		○		○		

● PRIMARY RESPONSIBILITY

◑ PRINCIPAL RESPONSIBILITY IN OSD

○ SECONDARY RESPONSIBILITY IN OSD

X MONITORING RESPONSIBILITY

Figure 2.

programs have failed to meet or even come close to initial goals.

So the hard question today is: What have we really done in the first year of this Administration? Have we taken decisive and substantial actions to improve our research and development management? Or do we offer nothing more than additional explanations and further pleas for understanding?

Actions. We *have* taken a number of important actions. I want to outline briefly the range of actions we have taken recently. . . .

The first broad category of new action is in the *redefinition, clarification and delegation of responsibilities in the weapon systems acquisition process throughout the department.* Let's see precisely what this means.

[Figure 2] defines responsibilities of the Office of the Secretary of Defense (OSD) and the military services at each stage in the process of acquiring major weapon systems. Defining these responsibilities, especially at the critical transition points, is fundamental to the new management policy set in motion by Secretary [of Defense] Laird and Deputy Secretary Packard.

Let me explain the three primary OSD responsibilities indicated in Figure 2.

In the past, DOD often was placed in the position of trying to fulfill overstated requirements with underdeveloped technology. Now, before we make the initial major *program decision,* we will review in detail and objectively the actual user needs, and then ask for only the technological capabilities needed for the minimum requirements. In short, we will ask only for what we really need and match the available technology to that need.

Following the contractors' submittals and military service validation, we will again review the initial program decision to make a formal *ratification* that the requirement is still sound, and that the technology is, in fact, available or can be developed along reasonable lines.

Finally, we intend to convince ourselves that the development has been completed fully before we make the *production decision.* We will confirm the technological achievements and establish the basis for an essentially risk-free production effort based upon realistic costs and schedule estimates.

Implementing this new policy has the overriding priority among my responsibilities.

The functions of my office, of the other offices within OSD, and of the services have been redefined. This action, which delegates more authority to the services to run programs once they have been approved, has clearly defined the office of the program manager as the place where accountability rests when decisions must be made and problems solved.

Within my office there is a new emphasis on more focused attention to broad mission areas on a multi-service basis, *i.e.,* the analysis and planning for department-wide reviews of policy, rather than detailed management of weapon systems.

Within the services, the senior officials and project managers now must confront much more clearly the priorities and tradeoffs within a constrained budget. Accountability for the development and production of systems now clearly rests with the program managers and the Service Secretaries. I think this is extremely important. The key people on our major programs know their responsibilities and know the range of their freedom of action. These are powerful management tools in which we have great confidence; I believe they should have been used more fully in the past.

My office, like all major technological enterprises, deals with a combination of technologically based "functional" problems, such as ordnance, guidance, or propulsion, *and* individual projects within each of these functional areas. In the late 1950s the office was organized by functions. During the 1960s, the emphasis shifted toward management of individual projects. Our new reappraisal of the needs of DOD in relation to my office leads us to the conclusion that we may have gone too far in managing by project, without an overview of the related projects and supporting technologies.

Accordingly, a second broad category of new actions, and one we are just beginning to move into deeply, is *mission analysis.* By this I mean the development of new policy and planning instruments similar to the Development Concept Papers (DCPs) which we have used in the past. The new "area papers"—imposing an explicit discipline of analysis just as the DCPs have done—will treat DOD-wide needs in areas such as air-to-ground attack, electronic countermeasures, and air defense, as well as areas of technology such as the environmental sciences and material sciences. Through collaboration of OSD and the services, we are setting the essential performance, cost and schedule requirements and establishing clearer priorities.

Given a clearer understanding of

program objectives and given a new management environment through greater delegation, we are prepared to *set up and monitor programs.* Thus, the third category of new actions is designed to streamline and sharpen the way in which each individual program is established and then is carried out. There are a number of actions that we have taken to help assure that programs are "ready" when we approve them and assure that they stay on track as they move through their life cycle.

One of the most important management actions was to introduce the *Development Concept Paper* which, as you recall, we began using in late 1967. In the last year it has become an even more significant part of the management approach within OSD.

The DCP is a summary top-management document for the Secretary of Defense that presents the rationale for starting, continuing, or stopping a development program at each critical decision point. It identifies the issues in each decision and assesses the important factors, including threat, risks, full military and economic consequences, and the pros and cons of each alternative. The key performance goals form the basis for program "milestones," a new concept I will discuss in a moment.

The DCP has become the principal decision-making instrument in setting up a major program. Once the Secretary of Defense has approved the DCP, it is a "contract" between the Secretary of Defense and the implementing Service Secretary to define the latitude of the service in managing the program within the thresholds for cost, performance and schedule that have been mutually selected.

Monitoring programs on a broad policy basis, when a program starts and throughout its life, is done by the new Defense Systems Acquisition Review Council (DSARC) established by Deputy Secretary of Defense Packard last year. The DSARC brings together the principals who considered the DCP for a personal face-to-face, focused dialogue when the service proposes to advance the program past a key milestone.

Thus, the DSARC discussions complement the DCP process by monitoring progress and reviewing the program status at the critical milestones. This is important when we must decide how much more early experimental work and competitive prototyping should be done. It is equally important when we move from development to production, a point at which poor decisions can be so costly in dollars and operational capability. In addition, the DSARC emphasizes the analysis of all cost data to assure that cost estimates are realistic.

One aspect of program management that we have been emphasizing this past year is scheduling by achievement in order to assess and minimize technical risks and uncertainties at the most efficient times. We do this by applying milestones to major systems contracts. Applying this milestone concept widely and systematically—and explicitly in contracts—is one of the most important innovations in management since I have been the Director of Defense Research and Engineering. The concept requires that specific achievements, such as avionics integration or successful flight test, be met by hardware tests before additional major financial commitments are made. Designing the milestones serves to bring together the key people from both the technological and systems planning areas so that every major "hurdle" in a program is discussed fully and passed clearly. With these milestones, each additional program commitment is made only *after* a goal has *actually* been reached rather than when it was *scheduled* to be reached. Most commonly, this has provided rights to the Government to delay the exercise of production options if specified milestones are not met.

Another new emphasis in setting up a program today is the *management review* which is designed to evaluate—and change, as necessary—the management framework proposed or in operation for each program. This review covers the choice of project manager and his key personnel to ensure that they are first-class technical managers and can stay with the program for as long a period as necessary. This review also assesses the line of communications and assignment of responsibilities for the entire program, and the procedures used for supporting functions on planning and procurement. The management review focuses on the elimination of unnecessary reports and paper work from the time we circulate requests for proposals.

Overall Objectives. Let me try to pull together the basic elements of our view about where we're going with these management actions.

Research and development represent one of the tools used to achieve the objectives of the Defense Department. Thus, all of the changes I have mentioned can be regarded as part of an evolutionary process of improving the techniques for defining the way in which the "research and development tool" will be used. For example, a DCP is a program decision document; it makes research and development policy and, in addition, it helps the officials in DSARC to control each research and development program and to change related policy when necessary.

Finally, the crucial point and future challenge in all of our actions is to "design to a price" instead of trying to control costs after the fact for those new systems which are required. All of us throughout OSD and the services must give and are giving this type of cost consciousness absolutely first priority.

The single most influential long range goal is to eliminate a syndrome which has grown up in the last decade: incorporating the most advanced technology into every system regardless of the cost. This syndrome pervades much of the initial design thinking at the working level throughout DOD and throughout defense industry. We must get the message throughout the system that we will not stand for unnecessary complexity and that price has as much priority as any other requirement. We must move toward the technical demands of a new kind of design in which the performance-price tradeoffs are assessed in ways similar to the design of commercial equipment.

All of our new management actions have this as their unifying theme: Control and reduce costs, and control the system acquisition process within a reshaped management environment that fixes accountability more clearly and delegates greater authority to the military services.

Focus on Research

Independent Research and Development

Statement by Dr. John S. Foster, Jr., Director, Defense Research and Engineering, before the Senate Ad Hoc Research and Development Subcommittee of the Committee on Armed Services, March 13, 1970.

I would like to use this opportunity to tell you how we visualize the particular significance of this industrial technical effort [independent research and development (IR&D)], in terms of its value to DOD as a customer and of its necessity to industry. I will then briefly describe the controls we exercise in these areas, discuss a few of the more important issues, and finally offer our proposed plan of action.

Significance of IR&D

Private companies that provide technology-based products and services, whether for the Government or for commercial customers, must maintain an active in-house advanced technology base to assure a continuing ability to respond with minimum delay to changes in customer needs. Such technical activity is also used by a company to open up new areas of technical interest, to guide other large scale research and development efforts, and to meet changes in customer priorities. . . . The cost of this new product development has been traditionally treated as a normal cost of sales or overhead [and is recovered through sales to all its customers]. . . .

From the customer's standpoint—in particular, with DOD as the customer—IR&D provides a number of benefits.

Complement to the DOD Technology Base. From a technical point of view, we look upon this broad vital base of industrial technical effort as a complement to our contracted research and development, particularly in the areas of research and exploratory development. We in the DOD are not—and must not become—so presumptious as to believe that we alone, within the limited defense research and development community, have the wisdom and ability to judge all those technical projects and approaches that may produce beneficial results. . . . In this way, we take advantage of the talents of the leaders of industry—eminent engineers and scientists—who manage the majority of our defense research programs through our major development contracts.

Forerunner to Contract Research and Development. Also, we benefit by having technical feasibility demonstrated by contractors that are performing experiments and, subsequently, analysing the data. Often this kind of effort leads to contracted research and development work aimed directly at meeting important military requirements. . . .

Lead in to Full-Scale Development and Production. While the main thrust of industry's IR&D effort is technological, there are instances in which this technical effort has resulted in a contractor's in-house development and demonstration of technologically advanced hardware prototypes. . . . It is also true that, without these on-going technical programs in industry, it would take longer and cost more for a contractor to develop a product for us under contract. Because the contractor contributes to the cost of IR&D, we get more than a dollar's worth of work for the dollar we expend.

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Producer of More Than One Technical Solution. Closely akin to proof of technical feasibility is the fact that, when several contractors are doing technical work in the same area—with the same objective, we are given an opportunity to compare different technical approaches; thus, we can choose the one which, at that particular time and under the prevailing circumstances, offers the best solution to the problem at hand. This would not be possible if the work were being funded out of company profits, without the arrangements governing IR&D. While this, from a technical view, is evidence of our need for this kind of work by industry, we also receive non-technical benefits. . . .

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IR&D Controls

The controls that are present in connection with IR&D expenditures by contractors are twofold. First, there are the natural competitive forces of the marketplace and, second, there are the additional controls that have been imposed for many years by DOD.

Natural Controls. Two factors motivate defense contractors to keep IR&D expenditures at an acceptable level. The first is the need to keep total overhead expenses within reasonable limits, because to ignore this fact could well mean the loss of new business. The second relates to the impact of the content and quality of a contractor's IR&D program upon his capability. Technological competition provides a strong stimulant to force companies to invest wisely in technology so as to ensure their future survival. Contractor top management must pay close attention to the choice, planning and execution of its IR&D programs. In many respects, this pressure is as effective as any system of review or regulation that we could devise.

. . . I am convinced that these forces do exist and that they do have a significant impact on the size and efficiency of contractor IR&D programs. However, these do not provide the strength and certainty of control that we feel is necessary. It is for this reason that we have imposed specific controls to supplement the natural forces I have just described.

Government Controls. The present system of managing IR&D casts the Government (DOD) in the role of the customer who broadly specifies his needs, and industry in the role of the innovator who is responsive to those needs. To fully appreciate how the system works, it is worthwhile to briefly look at current DOD procedures . . . in the management of IR&D. First, let me describe the advance agreement procedure used by DOD. It accomplishes several important objectives:

- It enables and requires contractors to plan IR&D programs in advance of expenditures, knowing approximately how many dollars will be recoverable.
- It clarifies the scope and type of effort considered applicable, thus reducing subsequent audit problems.
- It allows DOD to negotiate a reasonable dollar ceiling with the contractors before costs are incurred, so as to exercise a dollar control over a substantial portion of IR&D costs.

Advance agreements are carried out through the tri-service negotiation committee, with technical assistance from the Armed Services Research Specialists Committee.

Since it would be impossible for either committee to deal directly with the many thousands of contractors that have DOD contracts, both must confine their activities to the IR&D programs of about 110 defense-oriented plants which represent approximately 55 different companies. We have generally been able to negotiate agreements with major contractors, although there have been exceptions.

As the first step in negotiating an advance agreement, the contractor submits his proposed IR&D program to the Government for the ensuing year. It identifies areas of interest, outlines the objectives of each project, estimates the amount of money to be spent, and provides the background of key scientific personnel who will be engaged in the work. The proposal is reviewed by Army, Navy, Air Force and NASA laboratory personnel under the guidance of the Armed Services Research Specialists Committee. In addition to a technical review of the projects, the soundness of the planning is evaluated, and improvements that appear desirable in the contractor's program are identified and described.

In the process of establishing a suitable figure of allowable expenditures, the negotiator uses the technical evaluation as well as other kinds of business inputs. During the process, those projects that are not related to the functions and operations of the DOD, or that are out of consonance with public policy, are eliminated. Sharing arrangements and ceilings are also negotiated in order to establish maximum amounts chargeable to government contracts.

Since advance agreements are renewed each year, the negotiator reviews the past performance of the contractor against his previous year's plan. This is also used as input in establishing the level of support.

As a result of sharing arrangements, ceiling limitations and allocations to non-government business, the Government ultimately pays only a part of the contractor's total cost. For example, the aggregate of IR&D programs on which contractors had *advance agreements* for 1968 was $685 million. Of this amount, the committee identified $518 million as that considered reasonable by the Government, of which $299 million was DOD's share.

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Bid and Proposal

Bids or proposals are offers to the customer which are submitted upon the customer's request or on an unsolicited basis. Since much of the equipment that DOD buys is highly sophisticated, the technical portion of proposals is quite significant, and the effort necessary to develop and prepare it is a major portion of proposal cost.

DOD has traditionally recognized the advantages of competition in terms of better products at lower cost and has, therefore, encouraged more than a single bid or proposal, wherever possible. However, since only one award is normally made, a given contractor will win only a fraction of the contracts on which he proposes. The more competitive the product area, the lower the rate of contract capture. The cost of all proposal effort, therefore, both successful and unsuccessful, must be recovered in the price of the contracts won, whether commercial or government, if the contractor is to continue in business. Recovery of these costs is through overhead charge; therefore, each customer of a company shares this expense in the cost of the product he buys.

In summary, then, we follow the concept that the costs of bid and proposal are legitimate and normal in the process of doing business. Contrary to some impressions, the DOD has no "pot of money" set aside for bid-and-proposal costs. We have no contracts or grants for this kind of work; it is a part of contractor overhead and is shared by all customers when they contract for either development or production work. When a contractor does not have a current DOD contract, the costs of bid and proposal cannot be recovered from the DOD.

Other Technical Effort. I should also like to comment on something that has come to be known as other technical effort (OTE). It refers to miscellaneous technical costs that are incurred by a contractor in the operation of his facility, but which are not classified in his accounting records as either IR&D or bid and proposal. We recently became concerned about the relationship between these kinds of costs and IR&D and bid and proposal. We felt that some contractors were classifying certain efforts in accounts other than IR&D or bid and proposal when they should more properly have placed, at least some of them, in the IR&D or bid-and-proposal category. We, therefore, requested an audit of the overhead accounts of several major contractors to determine what types of effort could be found that were technical in nature, but which were not included in IR&D or bid-and-proposal accounts. These were then grouped together under the category of OTE. OTE reports have been prepared and submitted for several years, so we have had the opportunity to look at a good cross section of the types of technical effort included. As a result, we have found some efforts that relate to design and development of new products which, we have concluded, should be reclassified under the category of either IR&D or bid and proposal. Examples of these are feasibility and capability studies undertaken to determine whether current technology or resident technological capability is adequate to support the design and development of a new equipment or weapon system. Other examples are preproposal effort, predesign studies, and technical overhead.

Other efforts were found that did not belong in the IR&D or bid-and-proposal category, *e.g.*, charges for contractor technical personnel for the maintenance of complex test equipment, and engineering support of sales and marketing efforts. Such were clearly not of a research and development nature, since they add nothing to the store of technical knowledge and do not result in new or improved products. When our efforts on reclassification are complete, all effort now classified as OTE will be reclassified as IR&D or bid and proposal, or assigned to another overhead cost category that is more appropriate.

Changes Necessary. As a result of our experience with IR&D, it became evident to us several years ago that clarification and policy changes were needed. This included a need to better define IR&D, to recognize its relationship to both bid and proposal effort and other contractor technical effort that is independent in nature, and to establish a more objective and uniform approach to determining a "reasonable" allowance for these costs. . . .

Determination of "reasonable costs" in these areas was the major problem in formulating the proposed DOD policy. Based on the continuing belief that contractors should recover certain of their costs in these areas, DOD developed a proposed policy in December 1968 which was reviewed and approved by the Deputy Secretary of Defense. It is summarized as follows:

- IR&D and bid and proposal are so intimately related and so interdependent that actions taken should be equally applicable to both.
- The amount of IR&D and bid-and-proposal costs to be accepted by the Government would be determined by a formula that uses a company's historical use of IR&D or bid-and-proposal costs and sales dollars. The formula that was recommended and approved was:

> **For each company, annually compute the ratio of incurred IR&D or bid-and-proposal costs to sales for each of the preceding three years. Select the two highest annual ratios. Average them. This average ratio, times the sales for the current or projected year (dependent upon when the formula was applied) would establish the dollar amount considered reasonable. To prevent abnormal sales (either up or down) from providing an unreasonable result, a "ceiling" (120 percent) and a "floor" (80 percent) would also be established as a limit to a formula answer.**

- Either the Government or industry could appeal the allowance produced by the formula in extraordinary situations.
- In view of the relationship of IR&D and bid-and-proposal efforts, contractors would be permitted to offset ceilings independently established for IR&D and for bid and proposal by reducing one and increasing the other by a like amount.
- IR&D and bid-and-proposal costs would be burdened with overhead in the same manner as a contracted project, except that general and administrative (G&A) costs would not be included.

Also, the definition of the term "IR&D" was expanded to cover, in addition to basic and applied research and development, that work which is generally referred to as a system concept formulation study and/or which comprises a specific IR&D effort directed to the identification of a desirable new system, equipment, or component, or desirable modifications and improvements to existing systems, equipments, or components. Bid-and-proposal costs were also further defined to include costs of preparing, submitting and supporting, to the date of contract award, bids and proposals. While this decision was reached well over a year ago, the General Accounting Office's concern over our approach and subsequent Congressional interest in this subject have caused us to withhold implementation. Before I outline our current proposed action, let us examine several issues which are of present concern to both the Congress and the DOD. . . .

Other Major Issues

IR&D Budget Line-Item Control.

I have been asked on a number of occasions why these costs can't be made a line item in the budget. . . . We see significant problems in planning budgets and operating under the resulting appropriations if line-item controls are instituted for IR&D and bid and proposal. Management of such a system would require a complex maze of administrative procedures of doubtful effectiveness. . . .

Budget Planning. It should be recognized that IR&D and bid-and-proposal costs are very different from line items which presently appear in the budget projects of the research, development, test and evaluation (RDT&E) and production appropriations. At present, budget line items relate to specific products and equipment which are required by the DOD. An IR&D/bid-and-proposal line item would relate to each of these items subsequently placed on a contract with one or several contractors.

If line-item controls were directed, the question would be how to establish the amount needed for a line item. It would not be feasible to ask contractors how much IR&D and bid-and-proposal cost they propose against line items on a proposed new budget, because at that time even they would not know whether or not they would bid on these future projects.

The need for IR&D and bid and proposal funding varies considerably from contractor to contractor depending upon his product line, his position in industry as a designer or copier, the need for new business, or the number of proposals the Government may request in any one year. Moreover, a particular contractor's requirements may vary appreciably from year to year. This is especially true of the smaller contractors.

A major difficulty would also arise

in the treatment of subcontractors. . . . On a large program, several hundred subcontractors would receive contracts from the prime contractor. These, in turn, generate additional tiers of subcontractors, each such contract being awarded under a different purchasing system.

The composition of a prime contractor's subcontract structure changes frequently over the span of a major program. This would make it impossible to use the same planning factors from year to year at the prime contract level.

Even if such a control were feasible for prime contractors on major weapons programs, such an arrangement would be infinitely more complex in planning the IR&D and bid-and-proposal costs associated with the thousands of lesser items bought under the RDT&E and production appropriations of the services. Not only would we be dealing with a greater number of items, but with a case where the prime contractors number about 22,000. Here, too, the problem of subcontracts arises.

We conclude that the administrative problem of establishing a budget line item is of such magnitude that we see no practical way to accomplish it except to arbitrarily use a percentage of the procurement budget. Such a computation, unsupported by rationale based either on industry needs or DOD benefits, is completely contrary to the policy governing the annual planning for defense expenditures.

Operating Difficulties in Negotiating New Contracts. We anticipate difficulties in negotiating new contracts if line-item controls are established. IR&D and bid-and-proposal costs are included in the overhead costs of practically every contractor who negotiates a contract with the DOD. Each subcontractor who receives a contract from a prime includes IR&D and bid-and-proposal costs in his overhead. Thus, instead of placing an item on direct contract with one or two contractors, we would be faced with the task of trying to find some equitable, consistent procedure for spreading IR&D and bid and proposal over the thousands of contracts we and the prime contractors write during a given fiscal year.

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Operating Difficulties in Settlement of Completed Contracts. We anticipate great administrative complexity in negotiating annual overhead recovery rates for use in settlement of completed contracts. The reason is that line-item control amounts would vary from year to year. We anticipate that this would lead to different limitations by fiscal year. At any one time, the contractor might be operating under appropriations for three or more fiscal years. The allocation from the contractor's accounting pools to individual fiscal years' funding would be cumbersome and expensive, to say the least.

Bid-and-Proposal Line-Item Control. The problems of line-item controls are perhaps even more serious in the case of bid-and-proposal costs. The Government establishes the scope of work required in response to its requests for proposal. The Government issues these requests and selects prospective bidders. The Government defines, in considerable detail, how a proposal should be formulated, and determines how many projects it is ready to start in a particular time period. Thus, the number and cost of bids and proposals fluctuates greatly as a consequence of government action. The policy of fostering competition would be gravely challenged by line-item control on bid-and-proposal costs. Such control would pose problems in selecting contractors to bid and in limiting contractors' expenditures in bid preparation. . . .

We also consider line-item control of IR&D and bidding and proposal administratively infeasible for the foregoing reasons.

Relationship of IR&D to Contract Research and Development.

The use of contract research and development has been suggested as the vehicle with which to accomplish the current IR&D mission. Even though the primary purpose of contract research and development is to pursue new concepts in technology or system feasibility, its use in this expanded role would remove most of the advantages that make IR&D desirable [as previously explained in this statement].

We believe that the current contract research and development programs of the DOD represent a very good choice from among a much larger number of possible candidates. Choosing them is difficult, funds are limited, and the number of needs and of possible solutions is large, and proper management necessitates that the possibility of error be considered.

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IR&D on the national level is that small percentage (about 4 percent) of the DOD contract research and development budget which is centrally controlled with respect to funding and general subject area only, but is not subject to the same detailed management reviews as the 96-percent balance of research and development expenditures. Thus, it is aimed at exploiting the independent, imaginative, original and creative thinking of our contractors in anticipating DOD problems and decisions and, thus, to broaden the support base available to the DOD. Our view is that both private initiative and directed development are necessary, but at different times and in different places in the development cycle. The genius of the American industrial system is that it is geared to tap the creativity of all participants.

Comments on Senate Bill 3003

. . . I will attempt to summarize the thoughts on those concepts that we believe constitute the true intent of S. 3003 [a bill introduced in the Senate to provide more effective control over the expenditure of funds by DOD and NASA for IR&D and for other purposes].

First, the bill defines OTE to be a part of IR&D. We believe that the intent of this provision is to make certain that all research and development effort charged through overhead is identified in one proper cost category. We fully agree with this objective and, as I have already stated, we have developed redefinition of IR&D that will accomplish this.

Second, S. 3003 appears to require that no IR&D projects may be supported in whole or in part by the DOD and NASA, except where projects relate to, or augment, work on specific contracts, in which event costs of selected projects may be provided for in the contract. This requirement would, in our opinion, eliminate IR&D

by denying the independence which distinguishes it from contract research and development.

Third, S. 3003 would require defense contractors to submit technical details of all IR&D projects to DOD for review and inclusion in a government-wide data bank. We concur in this as a concept, except that to be administratively practicable we believe such a plan must be proved cost-effective and should be limited to major defense contractors.

Fourth, with respect to bid and proposal, S. 3003 would limit reimbursement to those bid-and-proposal projects which are applicable to the program of the agency concerned. The apparent intent here is to ensure that DOD reimburses contractors only for bids and proposals submitted to DOD. In our opinion, such a restriction would not reduce the cost of bid and proposal, but would result in a major increase in administrative effort on the part of DOD and the defense contractors involved. Present accounting procedures put bid-and-proposal costs into overhead with allocation to all current business.

Fifth, S. 3003 would limit reimbursement of bid-and-proposal costs to 1 percent of the direct material and labor costs on DOD contracts. In our opinion, bid-and-proposal costs have no significant relationship to direct material and labor, and such a base should not be used as a measure of reasonableness. Moreover, we estimate that the 1 percent limitation represents only about one-half of the bid-and-proposal expenses currently being incurred by defense contractors. Such a restriction would sharply curtail the amount of competition we could expect on our procurement programs.

DOD Proposed Plan

As a result, we have concluded that the type of dollar and technical control and review that will in the long run best satisfy the concerns of the Congress and the General Accounting Office, and provide the most satisfactory solution to the many complex problems inherent in IR&D and bid and proposal, can be achieved within the existing DOD administrative framework and that, therefore, futher legislation is not necessary. In fact, such legislation could be detrimental to both the Government and industry and, consequently, would not be in the best interests of the nation; it could result in more costly effort that might be of less benefit.

We have just completed a thorough and detailed review of the whole area of IR&D and bid and proposal management and control. We have looked at changes that could increase control without removing or unduly restricting the features of flexibility and inventiveness upon which the system depends for its value. We have selected a plan, now approved by the Deputy Secretary of Defense, that makes use of both the negotiated advance agreements and the DOD-developed formula. We feel these will satisfy both congressional concerns and our own, while keeping alive the vital independent nature of this work. The five elements of this approach are:

- Use individually negotiated advance agreements for the control and reimbursement of these costs for approximately 100 of the larger defense contractors. This will require that we increase the number of contractors with which we negotiate advance agreements by a factor of almost two. Such agreements, after a formalized detailed technical review of the IR&D program, will establish a separate dollar ceiling for the DOD's reimbursement of each of these costs, but will allow the contractor to combine the individual amounts into a single pool if he chooses. We will require that contractor burden these costs as he would for a contract, except that general and administrative costs would not be added. The requirement to negotiate an advance agreement will be enforced by automatically establishing a low threshold for recovery of costs where no advance agreement exists.
- Strengthen technical review and evaluation of contractor IR&D programs, as currently established under DOD Instruction 4105.52. Establish uniform review and evaluation procedures to be used throughout the DOD. The system will require review of a contractor's individual IR&D projects, and will take both his accomplishments and his proposed plan into consideration.
- A data bank will be established to provide a centralized body of IR&D project cost and technical information. This information will be available to the government technical community at large.
- Use the DOD-developed formula for control and determination of reasonableness of costs for the remaining large number of smaller companies who recover IR&D and bid-and-proposal costs. This will provide a workable system that can be uniformly applied—one that will assure results that can be easily monitored and adjusted as needed.
- The military departments will increase as necessary the support and resources needed to effectively perform the required IR&D technical reviews and evaluations.

Provided that the Congress does not pass legislation that would require different action on the part of DOD, we plan to move toward the early and orderly implementation of this plan.

Pratt and Whitney To Develop F-14, F-15 Engine

The Air Force and Navy have announced the selection of Pratt and Whitney Division of the United Aircraft Corp., West Palm Beach, Fla., as the developer and producer of the Navy F–14B and Air Force F–15 engines.

A first buy of 90 engines will be to support initial test aircraft for both services, at a target price of $448,162,600. Development and options for production of engines are scheduled through 1975, with additional options for two years production.

The F–14B and F–15 engines will be high performance, afterburning turbofans, based on the technology level demonstrated by the lift/cruise, advance turbine engine gas generator, and the B–1 engine development programs. Both will be in the 20,000- to 30,000-pound thrust class, having common gas generators, but will differ in the size of the fans, afterburners and thrust levels.

Executive service for the engine program is the Air Force.

ABOUT PEOPLE

DEPARTMENT OF DEFENSE

David O. Cooke is the new Principal Dep. Asst. Secretary of Defense (Administration).

Joseph J. Liebling has been designated Dep. Asst. Secretary, Security Policy, Office of the Asst. Secretary of Defense (Administration).

Rear Adm. Emmett P. Bonner, USN, has been named as Senior Navy Member, Weapons Systems Evaluation Group, Office of Dir., Defense Research and Engineering.

Brig. Gen. Daniel "Chappie" James Jr., USAF, is the new Dep. Asst. Secretary of Defense (Public Affairs).

New assignments announced by Hq., Defense Supply Agency (DSA), Cameron Station, Alexandria, Va., include: **Maj. Gen. Roland B. Anderson,** USA, is now Executive Dir., Supply Operations, Hq., DSA; and **Rear Adm. Grover C. Heffner,** SC, USN, has replaced **Maj. Gen. Emmett M. Tally Jr.,** USAF, as Commander, Defense Construction Supply Center, Columbus, Ohio. Maj. Gen. Tally has retired.

Brig. Gen. Herbert A Schulke, Jr., USA, has assumed duty as Dep. Dir., Operations, Defense Communications Agency, Arlington, Va.

DEPARTMENT OF THE ARMY

David H. Ward is now Dep. Under Secretary of the Army (International Affairs), succeeding **James V. Siena.**

Maj. Gen. Edward P. Smith is the new Dir. of Doctrine and Systems, Office of the Asst. Chief of Staff for Force Development, Hq., Dept. of the Army.

Maj. Gen. Edward H. de Saussure Jr. has succeeded **Maj. Gen. H. G. Davisson** as Commander, White Sands Missile Range, N.M. Maj. Gen. Davisson has retired.

Brig Gen. James W. Gunn has assumed duties as Dir. of Management, Review and Analysis, Office of the Comptroller of the Army.

The Office of the Chief of Research and Development has announced the following assignments: **Brig Gen. George Sammet Jr.,** Dir. of Plans and Programs; and **Col. George A. Lutz,** Dep. Dir. of Developments.

Brig. Gen. Otis E. Winn, USAF, has been appointed Asst. Commander, Military Traffic Management and Terminal Service (MTMTS), Washington, D.C. Also at MTMTS, **Col. James H. O'Brien,** USA, has been made Chief, Office of Public Affairs.

Col. Joe B. Lamb has assumed the duties of Dir. of Materiel, Army Combat Developments Command, Ft. Belvoir, Va.

Col George E. Rippey is the new Dir. of Communications Engineering, Army Strategic Communications Command, Ft. Huachuca, Ariz. Assuming Col. Rippey's former duties as Commander, Army Satellite Communications Agency, Ft. Monmouth, N.J., is **Col. Leland D. Wamsted.**

DEPARTMENT OF THE NAVY

Rear Adm. Parker B. Armstrong has been assigned as Commander, Antisubmarine Warfare Systems Project Office, Naval Material Command, Washington, D.C.

Rear Adm. John G. Dillon is the new Commander, Northern Div., Naval Facilities Engineering Command, Philadelphia, Pa. The Western Div., Naval Facilities Engineering Command, San Francisco, Calif., also has a new commander, **Rear Adm. Henry J. Johnson.**

Rear Adm. William H. House has been named a Dir., Strike Warfare Div., and CVAN Program Coordinator, Office of the Dep. Chief of Naval Operation (Fleet Operations and Readiness).

Rear Adm. John P. Weinel has been appointed Asst. Dep. Chief of Naval Operations (Plans and Policy).

DEPARTMENT OF THE AIR FORCE

The following have been confirmed as lieutenant generals: **Otto J. Glasser,** Dep. Chief of Staff, Research and Development, Hq., USAF; and **Russell E. Dougherty,** Dep. Chief of Staff, Plans and Operations, Hq., USAF.

Maj. Gen. Donavon F. Smith has assumed duties as Dir. of Operational Requirements and Development Plans, Office of the Dep. Chief of Staff, Research and Development, Hq., USAF.

The following brigadier generals have been confirmed to the rank of major general: **Jones E. Bolt,** Dep. Dir. of Operations for Strike Forces, Office of the Dep. Chief of Staff, Plans and Operations, Hq., USAF; **Maurice F. Casey,** Dir. of Transportation, Office of the Dep. Chief of Staff, Systems and Logistics, Hq., USAF; **William S. Chairsell,** Vice Commander, Armament Development and Test Center, AFSC, Eglin AFB, Fla.; **Henry L. Hogan III,** Dir., Office of Information, Office of the Secretary of the Air Force; and **Harold C. Teubner,** Dep. Chief of Staff, Comptroller, AFSC, Washington, D.C.

The following brigadier generals have been nominated for promotion to major general: **Leslie W. Bray Jr.,** Dir., Doctrine, Concepts and Objectives, Office of the Dep. Chief of Staff, Plans and Operations, Hq., USAF; **Ernest T. Cragg,** Dep. Dir. of Aerospace Programs, Office of the Dep. Chief of Staff, Programs and Resources, Hq., USAF; and **Roger K. Rhodarmer,** Dir. of Reconnaissance and Electronic Warfare, Office of the Dep. Chief of Staff, Research and Development, Hq., USAF.

Brig. Gen. Douglas T. Nelson is the new Dep. System Program Dir. for the B–1, Aeronautical Systems Div., AFSC, Wright-Patterson AFB, Ohio.

Status of Funds Quarterly Report

Outlays

Second Quarter, Fiscal Year 1970

(Thousands of Dollars)

Department of Defense

	Outlays				Unpaid obligations	
	Oct. 1969	Nov. 1969	Dec. 1969	Cum thru Dec. 1969	At start of year	As of 31 Dec. 1969
Military Personnel						
Activie forces	1,896,628	1,738,844	1,806,113	10,731,951	592,306	735,776
Reserve forces	85,345	71,724	75,122	554,003	152,294	143,097
Retired pay	226,822	237,198	238,993	1,362,196	6,354	8,215
Undistributed	8,238	−326	369	−40,790	—	40,790
Total—Military Personnel	2,217,032	2,047,441	2,120,597	12,607,360	750,955	927,878
Operation and Maintenance	1,878,263	1,874,512	1,734,884	10,863,435	3,924,991	4,166,150
Procurement						
Aircraft	675,661	695,471	675,504	4,109,282	7,701,062	5,908,321
Missiles	289,654	214,947	234,633	1,405,503	2,516,998	2,866,625
Ships	184,397	149,590	172,598	1,033,238	3,085,253	3,103,039
Tracked combat vehicles	26,087	27,319	26,610	136,677	454,414	414,806
Ordnance, vehicles and related equipment	595,571	384,664	399,148	2,465,376	5,690,581	5,434,712
Electronics and communications	107,211	90,180	98,054	545,308	1,621,409	1,538,600
Other procurement	126,710	123,400	204,904	967,582	2,016,381	1,918,931
Undistributed	57,715	2,850	28,939	431,685	128,925	−176,158
Total—Procurement	2,063,007	1,688,419	1,840,394	11,094,654	23,215,023	21,008,877
Research, Development, Test, and Evaluation						
Military sciences	83,998	67,943	67,741	432,945	712,919	690,481
Aircraft	79,174	123,689	114,916	613,437	681,935	682,059
Missiles	223,616	152,482	217,354	1,135,652	1,077,605	1,356,525
Astronautics	67,651	68,281	64,896	434,617	452,428	425,432
Ships	31,982	21,918	35,170	171,625	284,836	334,815
Ordnance, vehicles and related equipment	28,339	24,788	26,546	160,512	229,411	212,754
Other equipment	83,577	74,813	79,225	463,862	501,780	533,855
Program-wide management and support	36,912	47,708	27,233	217,931	282,019	239,879
Undistributed	−6,409	−6,915	4,816	40,438	38,151	−8,131
Total—Research, Development, Test, and Evaluation	628,838	574,709	637,896	3,671,019	4,261,084	4,467,667
Military Construction	123,026	86,801	105,213	665,326	1,806,093	1,491,490
Family Housing	57,583	51,175	53,344	314,470	256,946	193,489
Civil Defense	5,919	5,348	7,033	39,663	55,255	45,577
Other—Special Foreign Currency Program	46	37	89	280	363	467
Revolving and Management Funds	16,182	−272,734	99,226	−145,069	6,615,240	6,367,728
Applicable Receipts	−11,459	−3,997	−13,154	−59,045	—	—
Subtotal—Federal Funds	6,978,437	6,051,713	6,585,521	39,052,093	40,885,950	38,669,323
Trust Funds	5,785	−690	−1,189	3,832	4,821	4,738
Interfund Transactions	−2,599	242	−252	−2,612	—	—
Total—Military Functions	6,981,623	6,051,265	6,584,079	39,053,312	40,890,771	38,674,061
Military Assistance						
Federal Funds	61,525	64,559	47,578	296,737	1,562,839	1,324,925
Trust Funds	9,740	7,003	−15,256	−5,254	227,015	189,874
Total—Military Assistance	71,266	71,560	32,323	291,483	1,789,854	1,514,798
TOTAL—DEPARTMENT OF DEFENSE	7,052,888	6,122,827	6,616,402	39,344,796	42,680,624	40,188,860

Department of the Army

Military Personnel						
Active forces	767,332	694,670	754,672	4,305,103	213,798	346,538
Reserve forces	54,081	44,615	49,121	370,859	115,658	104,039
Undistributed	6,203	12,864	−3,777	−54,650	—	54,650
Total—Military Personnel	827,616	752,149	800,016	4,621,312	329,457	505,227
Operation and Maintenance	665,794	681,277	673,773	3,868,060	1,337,348	1,354,489
Procurement						
Aircraft	68,959	74,041	81,144	452,546	1,063,782	790,103
Missiles	59,435	53,101	62,918	327,107	848,404	1,076,661
Tracked combat vehicles	26,186	20,306	29,899	127,341	431,068	384,128
Ordance, vehicles and related equipment	180,195	179,406	221,396	1,101,041	2,965,280	2,809,542
Electronics and communications	38,678	32,262	33,844	179,075	581,475	483,120
Other procurement	39,222	38,552	31,653	201,297	682,896	592,073
Undistributed	47,962	11,441	20,878	401,095	39,722	−231,199
Total—Procurement	460,637	409,109	481,732	2,789,502	6,612,627	5,904,428
Research, Development, Test, and Evaluation						
Military sciences	10,340	11,181	14,098	68,955	96,888	110,484
Aircraft	5,189	8,008	5,578	33,877	89,782	88,939
Missiles	80,309	53,671	84,798	408,361	419,831	589,040
Astronautics	606	345	575	3,291	3,813	4,180
Ordnance, vehicles and related equipment	14,503	12,763	12,980	81,554	115,667	112,477
Other equipment	35,907	30,012	28,013	170,026	196,095	195,056
Program-wide management and support	4,863	3,916	4,880	29,018	32,104	33,342
Undistributed	−5,559	13,212	−13,263	24,970	13,651	−14,732
Total—Research, Development, Test, and Evaluation	146,157	133,109	137,660	820,053	967,831	1,118,786
Military Construction	46,535	44,412	30,978	245,782	776,104	684,075
Revolving and Management Funds	−10,469	−17,593	19,436	120,447	1,856,891	1,628,478
Applicable Receipts	−9,137	1,142	−2,608	−23,977	—	—
Subtotal—Federal Funds	2,127,132	2,003,606	2,140,988	12,441,179	11,880,257	11,195,483
Trust Funds	5,505	−1,121	−1,370	2,773	89	−193
TOTAL—DEPARTMENT OF ARMY	2,132,637	2,002,485	2,139,619	12,443,953	11,880,346	11,195,289

Department of the Navy

	Outlays				Unpaid obligations	
	Oct. 1969	Nov. 1969	Dec. 1969	Cum thru Dec. 1969	At start of year	As of 31 Dec. 1969
Military Personnel						
Active forces	588,690	508,344	525,192	3,185,627	168,734	218,989
Reserve forces	15,040	12,539	12,645	87,381	23,320	25,322
Undistributed	−1,746	−3,312	1,708	16,271	—	−16,271
Total—Military Personnel	601,984	517,571	539,545	3,289,279	192,054	228,040
Operation and Maintenance	503,411	441,993	398,634	2,881,549	1,537,613	1,699,384
Procurement						
Aircraft	226,574	182,571	202,621	1,227,073	2,861,615	2,223,988
Missiles	68,285	45,531	46,981	320,623	703,716	759,435
Ships	184,397	149,590	172,598	1,033,238	3,085,253	3,103,039
Tracked combat vehicles	−99	7,013	−3,289	9,336	23,346	30,678
Ordnance, vehicles and related equipment	183,010	107,347	93,997	710,701	1,536,287	1,351,925
Electronics and communications	34,225	32,265	30,398	195,755	576,715	564,248
Other procurement	70,311	66,592	94,973	479,108	1,194,841	1,182,535
Undistributed	522	1,742	−58	16,877	71,369	50,416
Total—Procurement	767,225	592,649	638,223	3,992,712	10,053,142	9,266,265
Research, Development, Test, & Evaluation						
Military sciences	16,150	11,089	13,071	82,702	129,992	120,607
Aircraft	37,914	39,788	54,275	250,947	253,929	366,495
Missiles	53,931	33,543	42,846	274,194	291,240	302,960
Astronautics	1,653	1,115	1,796	8,958	15,598	18,104
Ships	31,982	21,918	35,170	171,625	284,836	334,815
Ordnance, vehicles and related equipment	13,836	12,025	13,566	78,958	113,744	100,277
Other equipment	15,889	12,970	17,253	86,223	77,139	161,173
Program-wide management and support	8,209	15,802	3,114	43,194	219,464	163,782
Undistributed	−82	−5,689	6,841	4,545	14,446	8,098
Total—Research, Development, Test, & Evaluation	179,483	142,560	187,932	1,001,346	1,400,388	1,576,311
Military Construction	33,302	15,445	37,374	191,567	616,207	562,758
Revolving and Management Funds	−14,103	−61,990	99,194	−37,172	2,199,935	2,183,274
Applicable receipts	−669	−3,823	−7,647	−21,706	—	—
Subtotal—Federal Funds	2,070,634	1,644,403	1,893,256	11,297,575	15,999,338	15,516,031
Trust Funds	608	−56	879	2,971	277	181
Interfund Transactions	−2,599	242	−252	−2,612	—	—
TOTAL—DEPARTMENT OF THE NAVY	2,068,642	1,644,590	1,893,883	11,297,934	15,999,615	15,516,211

Department of the Air Force

Military Personnel						
Active forces	540,606	535,830	526,249	3,241,221	209,774	170,249
Reserve forces	16,224	14,570	13,356	95,763	13,316	13,736
Undistributed	3,781	−9,878	2,438	−2,411	—	—
Total—Military Personnel	560,611	540,522	542,043	3,334,573	223,090	186,396
Operation and Maintenance	611,793	665,236	565,504	3,548,275	953,240	981,156
Procurement						
Aircraft	380,128	438,859	391,739	2,429,663	3,775,665	2,894,230
Missiles	161,934	116,315	124,734	757,773	964,878	1,030,529
Ordnance, vehicles and related equipment	232,274	97,760	83,711	653,188	1,188,875	1,273,169
Electronics and communications	33,937	24,917	33,527	166,769	455,843	486,113
Other procurement	5,818	10,850	68,944	250,667	95,195	96,295
Undistributed	9,304	−10,311	7,813	13,371	17,834	4,967
Total—Procurement	823,395	678,390	710,469	4,271,432	6,498,290	5,785,303
Research, Development, Test, & Evaluation						
Military sciences	15,109	13,570	9,173	68,461	90,842	90,921
Aircraft	36,071	75,893	55,063	328,613	338,224	226,625
Missiles	89,376	65,268	89,710	453,097	366,534	464,575
Astronautics	65,392	66,821	62,524	422,367	433,017	403,148
Other equipment	31,781	31,831	33,959	207,613	228,546	177,626
Program-wide management and support	23,840	27,990	19,239	145,719	30,451	42,705
Undistributed	−768	−14,438	11,238	10,923	10,054	−1,497
Total—Research, Development, Test, & Evaluation	260,800	266,936	280,905	1,636,793	1,497,668	1,404,103
Military Construction	41,722	26,251	36,114	221,824	393,810	229,127
Revolving and Management Funds	21,410	−168,201	−24,614	−228,069	1,276,941	1,494,260
Applicable Receipts	−1,652	−1,341	−2,897	−13,350	—	—
Subtotal—Federal Funds	2,318,078	2,007,821	2,107,525	12,771,479	10,843,039	10,080,345
Trust Funds	−328	487	−698	−1,912	4,455	4,751
TOTAL—DEPARTMENT OF THE AIR FORCE	2,317,751	2,008,307	2,106,827	12,769,567	10,847,494	10,085,069

Defense Agencies/Office of the Secretary of Defense

	Outlays				Unpaid obligations	
	Oct. 1969	Nov. 1969	Dec. 1969	Cum thru Dec. 1969	At start of year	As of 31 Dec. 1969
Military Personnel						
Retired Pay	226,822	237,198	238,993	1,362,196	6,354	8,215
Operation and Maintenance	97,266	86,006	96,971	565,550	96,790	131,121
Procurement						
Ordnance, vehicles and related equipment	92	151	44	446	139	76
Electronics and communications	371	736	285	3,709	7,376	5,119
Other procurement	11,359	7,406	9,334	36,510	43,449	48,028
Undistributed	−73	−22	306	342	—	−342
Total—Procurement	11,748	8,272	9,970	41,008	50,964	52,881
Research, Development, Test, & Evaluation						
Military sciences	42,399	32,103	31,399	212,827	395,197	368,469
Military Construction	1,467	693	748	6,154	19,972	15,529
Family Housing	57,583	51,175	53,344	314,470	256,946	193,488
Other—Special Foreign Currency Program	46	37	89	280	363	467
Revolving and Management Funds	19,343	−24,949	5,208	−276	1,281,474	1,061,718
Applicable Receipts	—	−2	−4	−13	—	—
Subtotal—Federal Funds	456,673	390,535	436,720	2,502,198	2,108,061	1,831,888
Trust Funds	—	—	—	—	—	—
TOTAL—DEFENSE AGENCIES/OSD	456,673	390,535	436,720	2,502,198	2,108,061	1,831,888

Office of Civil Defense

Civil Defense	5,919	5,348	7,033	39,663	55,255	45,577

Obligations

Department of Defense

	Available for obligation	Obligations			Cum thru 31 Dec. 1969	Unobligated balance 31 Dec. 1969
		Oct. 1969	Nov. 1969	Dec. 1969		
Military Personnel						
Active forces	20,034,400	1,832,331	1,790,560	1,779,844	11,021,620	9,012,780
Reserve forces	1,020,605	73,285	73,732	71,399	542,968	477,637
Total—Military Personnel	21,055,005	1,905,616	1,864,292	1,851,244	11,564,589	9,490,416
Retired Military Personnel						
Retired Pay, Defense	2,735,000	226,751	237,330	239,417	1,363,843	1,371,157
Operation and Maintenance	23,104,267	2,283,010	1,737,545	1,729,806	12,134,993	10,969,275
Procurement						
Aircraft	10,101,413	479,664	326,817	574,685	2,573,397	7,528,016
Missiles	4,098,622	332,669	206,613	585,488	1,788,532	2,310,090
Ships	5,011,431	215,560	318,560	164,523	1,108,509	3,902,922
Tracked combat vehicles & other weapons	360,305	10,480	21,616	31,122	146,532	213,773
Ordnance, vehicles and related equipment	6,652,977	813,190	401,541	369,691	3,166,405	3,486,572
Electronics and communications	2,046,162	109,362	83,973	115,217	523,045	1,523,117
Other procurement	3,059,400	116,585	158,138	169,678	1,029,144	2,030,257
Undistributed	−94,848	18	−953	−2,540	−4,302	−90,546
Total—Procurement	31,235,462	2,077,529	1,516,305	2,007,865	10,331,263	20,904,199
Research, Development, Test, & Evaluation						
Military sciences	1,014,164	90,056	65,462	59,445	446,574	567,572
Aircraft	1,698,703	43,225	74,218	29,955	621,155	1,068,548
Missiles	2,529,218	353,343	144,775	204,375	1,489,726	1,039,492
Astronautics	876,654	53,651	66,680	45,358	437,893	438,761
Ships	349,707	36,190	13,147	16,134	228,394	121,313
Ordnance, vehicles, & related equipment	339,692	8,286	9,754	13,348	147,749	191,943
Other equipment	1,187,670	68,443	53,978	63,791	509,556	678,114
Program-wide management & support	658,259	38,768	55,903	28,970	298,925	359,334
Emergency fund	75,000	—	—	—	—	75,000
Undistributed	−14,690	−1,040	341	−137	−1,851	−12,840
Total—Research, Development, Test & Evaluation	8,705,359	690,925	484,255	461,240	4,178,121	4,527,238
Military Construction	3,197,727	70,948	139,465	113,241	597,998	2,599,728
Family Housing	689,837	64,002	30,146	33,613	256,871	432,966
Civil Defense	74,096	3,482	3,750	6,806	30,318	43,778
Other—Special Foreign Currency	15,162	76	63	117	384	14,777
Revolving and Management Funds	22,884,132	1,878,146	1,628,560	1,440,886	11,087,108	11,797,027
Offsetting receipts	−134,665	−8,776	−8,553	−12,798	−58,707	−75,958
Subtotal—Federal funds	113,561,384	9,191,708	7,633,159	7,871,436	51,486,781	62,074,603
Trust funds	75,122	15,662	3,674	4,993	32,912	42,209
Interfund transactions	−7,200	−18	242	−252	−2,612	−4,588
Total—Military Functions	113,629,306	9,207,353	7,637,075	7,876,177	51,517,081	62,112,225
Military Assistance						
Federal funds	250,145	14,262	8,956	−4,964	140,418	109,727
Trust funds	1,861,811	4,314	−1,420	−16,737	−42,395	1,904,206
Total—Military Assistance	2,111,956	18,576	7,536	−21,701	98,023	2,013,933
TOTAL—DEPARTMENT OF DEFENSE	115,741,262	9,255,929	7,644,610	7;854,477	51,615,104	64,126,158

Department of the Army	Available for obligation	Obligations Oct. 1969	Nov. 1969	Dec. 1969	Cum thru 31 Dec. 1969	Unobligated balance 31 Dec. 1969
Military Personnel						
Active forces	8,229,000	734,103	719,462	734,561	4,501,687	3,727,313
Reserve forces	665,400	47,290	47,219	45,477	357,698	307,702
Total—Military Personnel	8,894,400	781,393	766,681	780,039	4,859,386	4,035,014
Operation and Maintenance	8,422,064	818,904	588,285	632,820	4,311,909	4,110,155
Procurement						
Aircraft	817,249	51,561	21,377	25,288	187,542	629,707
Missiles	977,190	110,720	28,053	323,157	568,175	409,015
Tracked combat vehicles	314,979	9,719	21,110	16,333	129,864	185,115
Ordnance, vehicles and related equipment	4,136,575	640,532	226,773	226,744	1,900,222	2,236,353
Electronics and communications	782,112	26,534	16,102	9,862	101,733	680,379
Other procurement	967,263	42,353	9,063	33,637	149,366	817,897
Undistributed	151,106	−966	−88	−1,016	−2,013	153,119
Total—Procurement	8,146,474	880,453	332,390	634,005	3,034,889	5,111,585
Research, Development, Test, & Evaluation						
Military sciences	191,102	13,055	10,424	11,441	100,787	90,315
Aircraft	152,719	4,351	11,615	5,957	35,821	116,898
Missiles	936,586	219,190	32,762	100,869	586,053	350,533
Astronautics	15,399	522	524	1,099	3,660	11,739
Ordnance, vehicles and related equipment	220,650	5,822	5,699	8,760	82,375	138,275
Other equipment	473,452	19,082	23,577	34,895	176,349	297,103
Program-wide management and support	67,762	5,362	4,847	4,080	32,103	35,660
Undistributed	−33,060	−63	38	140	−500	−32,560
Total—Research, Development, Test, & Evaluation	2,024,611	267,321	89,486	167,241	1,016,648	1,007,963
Military Construction	1,458,606	25,853	50,467	50,907	267,622	1,190,984
Revolving and Management Funds	6,085,603	469,823	361,613	374,168	2,573,840	3,511,763
Applicable receipts	−67,611	−4,601	−3,388	−2,565	−23,925	−43,686
Subtotal—Federal Funds	34,964,147	3,239,146	2,175,534	,2636,615	16,040,369	18,923,778
Trust Funds	32,409	6,860	72	1	10,332	22,077
TOTAL—DEPARTMENT OF THE ARMY	**34,996,557**	**3,246,006**	**2,175,606**	**2,636,616**	**16,050,701**	**18,945,856**

Department of the Navy

Military Personnel						
Active forces	5,940,100	562,544	526,869	506,955	3,258,285	2,681,815
Reserve forces	176,570	10,444	11,994	11,814	89,851	86,719
Total—Military Personnel	6,116,670	572,988	538,863	518,769	3,348,136	2,768,534
Operation and Maintenance	6,322,036	695,492	495,994	490,458	3,399,728	2,922,308
Procurement						
Aircraft	2,816,864	157,200	128,548	155,042	626,998	2,189,866
Missiles	1,044,079	47,502	133,372	27,361	393,319	650,760
Ships	5,011,431	215,560	318,560	164,523	1,108,509	3,902,922
Tracked combat vehicles	45,326	761	506	14,789	16,668	28,658
Ordnance, vehicles and related equipment	1,453,010	52,267	65,617	90,519	528,318	924,692
Electronics and communications	598,521	49,469	30,044	41,632	187,696	410,825
Other procurement	1,501,565	58,319	139,233	48,606	585,718	915,847
Undistributed	−631,404	816	−851	−1,521	−2,743	−628,661
Total—Procurement	11,839,390	581,895	815,028	540,949	3,444,480	8,394,910
Research, Development, Test, & Evaluation						
Military sciences	101,417	16,719	4,384	6,744	76,508	24,909
Aircraft	866,334	37,245	45,330	16,852	363,578	502,756
Missiles	544,914	37,377	21,362	56,722	294,571	250,343
Astronautics	25,323	1,037	3,613	1,371	11,514	13,809
Ships	349,707	36,190	13,147	16,134	228,394	121,313
Ordnance, vehicles and related equipment	119,042	2,464	4,055	4,588	65,374	53,668
Other equipment	276,433	30,877	13,066	13,615	171,363	105,070
Program-wide management and support	260,702	10,288	26,451	7,311	103,176	157,526
Undistributed	−5,327	−1,206	330	−259	−1,135	−4,192
Total—Research, Development, Test, & Evaluation	2,538,545	170,991	131,738	123,078	1,313,343	1,225,202
Military Construction	1,212,206	42,426	79,362	55,834	272,048	940,159
Revolving and Management Funds	8,252,987	655,263	556,877	569,292	3,887,108	4,365,879
Applicable Receipts	−37,696	−3,242	−3,831	−7,646	−21,704	−15,992
Subtotal—Federal Funds	36,244,138	2,715,810	2,614,035	2,290,733	15,643,139	20,600,999
Trust Funds	15,605	932	398	3,178	6,301	9,304
Interfund Transactions	−7,200	−18	242	−252	−2,612	−4,588
TOTAL—DEPARTMENT OF THE NAVY	**36,252,543**	**2,716,724**	**2,614,674**	**2,293,658**	**15,646,827**	**20,605,716**

Department of the Air Force

	Available for obligation	Obligations			Cum thru 31 Dec. 1969	Unobligated balance 31 Dec. 1969
		Oct. 1969	Nov. 1969	Dec. 1969		
Military Personnel						
Active forces	5,865,300	535,684	544,229	538,328	3,261,648	2,603,652
Reserve forces	178,635	15,551	14,519	14,108	95,419	83,216
Total—Military Personnel	6,043,935	551,235	558,748	552,436	3,357,067	2,686,868
Operation and Maintenance	7,202,948	660,440	562,755	507,443	3,801,486	3,401,462
Procurement						
Aircraft	6,467,300	270,903	176,892	394,355	1,758,857	4,708,443
Missiles	2,077,353	174,447	45,188	234,970	827,038	1,250,315
Ordnance, vehicles and related equipment	1,062,711	120,331	109,004	52,404	737,482	325,229
Electronics and communications	655,846	33,168	36,889	63,614	232,164	423,682
Other procurement	465,636	4,298	7,784	69,849	251,767	213,869
Undistributed	383,961	168	−13	−4	454	383,507
Total—Procurement	11,112,807	603,315	375,744	815,192	3,807,766	7,305,041
Research, Development, Test, & Evaluation						
Military sciences	178,842	15,297	9,880	9,653	80,365	98,477
Aircraft	670,650	1,629	17,273	7,146	221,756	448,894
Missiles	1,047,718	96,776	90,651	46,784	609,102	438,616
Astronautics	835,932	52,092	62,543	42,888	422,719	413,213
Other equipment	437,785	18,484	17,335	15,281	161,844	275,941
Program-wide management and support	329,794	23,118	24,605	17,579	163,646	166,148
Undistributed	23,697	229	−27	−18	−216	23,912
Total—Research, Development, Test, & Evaluation	3,524,418	207,628	222,257	139,314	1,659,216	1,865,202
Military Construction	463,505	2,585	9,624	6,207	56,619	406,887
Revolving and Management Funds	4,868,553	477,972	472,562	283,862	3,123,046	1,745,507
Offsetting Receipts	−29,323	−1,639	−1,332	−2,583	−13,043	−16,280
Subtotal—Federal Funds	33,186,844	2,501,537	2,200,358	2,301,871	15,792,157	17,394,687
Trust Funds	27,108	7,871	3,204	1,815	16,280	10,828
TOTAL—DEPARTMENT OF THE AIR FORCE	33,213,951	2,509,409	2,203,562	2,303,685	15,808,437	17,405,514

Defense Agencies/Office of the Secretary of Defense

Military Personnel						
Retired pay	2,735,000	226,751	237,330	239,417	1,363,843	1,371,157
Operation and Maintenance	1,157,219	108,175	90,510	99,085	621,870	535,349
Procurement						
Ordnance, vehicles and related equipment	681	60	147	24	383	298
Electronics and communications	9,683	191	938	109	1,452	8,231
Other procurement	124,937	11,614	2,058	17,586	42,293	82,641
Undistributed	1,489	—	—	—	—	1,489
Total—Procurement	136,790	11,866	3,143	17,719	44,128	92,662
Research, Development, Test, & Evaluation						
Military sciences	542,785	44,985	40,774	31,607	188,914	353,871
Emergency fund	75,000	—	—	—	—	75,000
Undistributed	—	—	—	—	—	—
Total—Research, Development, Test, & Evaluation	617,785	44,985	40,774	31,607	188,914	428,871
Military Construction	63,409	85	12	293	1,710	61,699
Family Housing	689,837	64,002	30,146	33,613	256,871	432,966
Other—Special Foreign Currency Program	15,162	76	63	116	384	14,778
Rovolving and Management Funds	3,676,991	275,087	237,508	213,564	1,503,113	2,173,878
Offsetting Receipts	−35	706	−2	−4	−35	—
Subtotal—Federal Funds	9,092,158	731,732	639,484	635,411	3,980,798	5,111,361
Trust Funds	—	—	—	—	—	—
TOTAL—DEFENSE AGENCIES/OSD	9,092,158	731,732	639,484	635,411	3,980,798	5,111,361

Office of Civil Defense

Civil Defense	74,096	3,482	3,750	6,806	30,318	43,778

Military Assistance

Federal Funds	250,145	14,262	8,956	−4,964	140,418	109,727
Trust Funds	1,861,811	4,314	−1,420	−16,737	−42,395	1,904,206
TOTAL—MILITARY ASSISTANCE	2,111,956	18,576	7,536	−21,701	98,023	2,013,933

NOTE: All outlay amounts are on a net Treasury basis (gross payments less reimbursement collections), whereas obligations and unpaid obligations are on a gross basis (inclusive of reimbursable activity performed by components of DOD for each other). Therefore, unpaid obligations as of the end of the reporting month cannot be computed from other figures in this report.

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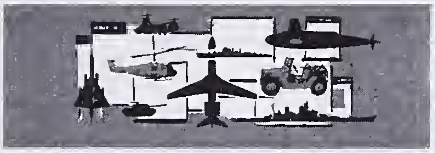

DEFENSE PROCUREMENT

Contracts of $1,000,000 and over awarded during the month of March 1970.

DEFENSE SUPPLY AGENCY

2—**Standard Oil Co.**, Louisville, Ky. $2,088,688. Fuel oil and gasoline. Defense Fuel Supply Center, Alexandria, Va. DSA 600-70-D-1258.

—**Varian Associates, Eimac Div.**, San Carlos, Calif. $1,318,296 (contract modification). 141,600 electron tubes, 7034/4X150A. Defense Electronics Supply Center, Dayton, Ohio. DSA 900–69–D–7811.

3—The Defense Fuel Supply Center, Alexandria, Va., issued the following indefinite quantity contracts for fuel oil and gasoline:

Gulf Oil Corp., Houston, Tex. $2,988,871. DSA 600–70–D–1234.

Esso Standard Oil Co., San Juan, P.R. $1,339,084. DSA 600–70–D–1232.

13—**United Tractor and Equipment Co.**, Rockville, Md. $1,326,480. 358 warehouse tractors (4,000 pound capacity). Chesterton, Ind. Defense General Supply Center, Richmond, Va. DSA 400–70–C–4251.

16—The Defense Fuel Supply Center, Alexandria, Va., issued the following contracts:

Mobil Oil Corp., New York, N.Y. $4,676,241. Fuel oil for the Army and Navy. DSA 600–70–D–1288.

Gulf Oil Trading Co., Washington, D.C. $1,315,450. No. 6 fuel oil for the Navy. DSA 600–70–D–1282.

17—**Texaco, Inc.**, Long Island City, N.Y. $1,500,000. 750,000 barrels of No. 6 fuel oil. Defense Fuel Supply Center, Alexandria, Va. DSA 600–70–D–1156.

18—The Defense Personnel Support Center, Philadelphia, Pa., awarded the following contracts:

Lancer Clothing Corp., Gainesville, N.Y. $1,333,040. 30,400 pairs of flying coveralls for the Air Force. Land Manufacturing Co., Inc., Wichita, Kan. DSA 100–70–C–1632.

Mason and Hughes, Inc., Philadelphia, Pa. $1,455,978. 35,000 pairs of Air Force flying coveralls. Allen Overall Co., Monroe, N.C. DSA 100–70–C–1633.

Lion Uniform, Inc., Dayton, Ohio. $1,181,832. 27,600 pairs of Air Force flying coveralls. Williamsburg, Ky. DSA 100–70–C–1631.

CONTRACT LEGEND

Contract information is listed in the following sequence: Date—Company — Value — Material or Work to be Performed—Location of Work Performed (if other than company plant) — Contracting Agency—Contract Number.

19—The Defense Fuel Supply Center, Alexandria, Va., issued the following contracts for No. 6 fuel oil for the Navy:

Atlantic Richfield Corp., Los Angeles, Calif. $3,793,000. DSA 600–70–D–1306.

Shell Oil Co., New York, N.Y. $1,110,000. DSA 600–70–D–1308.

20—**Bucyrus-Erie Co.**, Evansville, Ind. $1,987,776. 23 crawler-mounted 40-ton shovel cranes. Erie, Pa. Defense Construction Supply Center, Columbus, Ohio. DSA–700–70–C–8985.

25—**DeRossi and Son Co.**, Vineland, N.J. $1,616,000. 100,000 men's wool serge Army coats. Defense Personnel Support Center, Philadelphia, Pa. DSA 100–70–C–1659.

26—**Lester D. Lawson and Co.**, Long Beach, Calif. $2,613,290. 95,760 cases of ration supplement sundries packs. Boothe Packing Co., Modesto, Calif. Defense Personnel Support Center, Philadelphia, Pa. DSA 13H-70–C–S500.

—**Standard Oil Co. of Calif.**, San Francisco, Calif. $2,699,669. 18,450,201 gallons of gasoline and kerosene. Dutch Harbor, Alaska. Defense Fuel Supply Center, Alexandria, Va. DSA 600–70–C–1354.

27—The Defense Fuel Supply Center, Alexandria, Va., issued the following contracts:

Refineria Panama, S.A., New York, N.Y. $3,885,000. 2,500,000 barrels Navy no. 6 fuel oil. Rep. of Panama. DSA 600–70–D–1455.

Mobil Oil Corp., New York, N.Y. $1,102,800. 600,000 barrels Navy no. 6 fuel oil. Balboa, Canal Zone. DSA 600–70–D–1454.

Pittston Clinchfield Coal Sales Corp., New York, N.Y. $2,520,000. 240,000 net tons of bituminous coal for the Army. Clinchfield, Va. DSA 600–70–D–0186.

30—The Defense Personnel Support Center, Philadelphia, Pa., awarded the following contracts:

General Foods Corp., White Plains, N.Y. $2,846,278. 4,404,640 units (800 grams) of instant rice for the Republic of Vietnam Air Force operational ration program. Dover, Del. DSA 13H–70–C–V100.

Riviana Foods, Inc., Houston, Tex. $1,151,764. 1,867,700 units of instant rice for the RVNAF operational ration program. DSA 13H–70–C–V101.

—**United Tractor and Equipment Co.**, Rockville, Md. $1,284,830. 358 warehouse tractors, 4,000 pound capacity. Chesterton, Ind. Defense General Supply Center, Richmond, Va. DSA 400–70–C–4251.

31—**Ingersoll Rand Co.**, Cleveland, Ohio. $1,424,408. 112 pneumatic tool and compressor units. Mocksville, N.C. Defense Construction Supply Center, Columbus, Ohio. DSA 700–70–C–9170.

—**American Oil Co.**, Chicago, Ill. $3,462,931. 24,444,300 gallons of fuel oil and motor gasoline. Defense Fuel Supply Center, Alexandria, Va. DSA 600–70–D–1072.

DEPARTMENT OF THE ARMY

2—**Magnavox Co.**, Urbana, Ill. $1,039,965. Direction computers and memory units for M18 howitzer computers. Frankford Arsenal, Philadelphia, Pa. DA–AA25–70–C–0487.

—**Universal Constructors, Inc.**, Albuquerque, N.M. $3,552,988. Construction of the south diversion channel on the Albuquerque Diversions Channel Project. Army Engineer District, Albuquerque, N.M. DA–CW47–70–C–0004.

—**General Electric Co.**, Portland, Ore. $1,181,020. Three-phase power transformers (208,000 KVA) for the Dalles Dam Project, Ore. Pittsfield, Mass. Army Engineer District, Portland, Ore. DA–CW57–70–C–0084.

—**Whittaker Power System Corp.**, Primos, Pa. $3,578,949 (contract modification). 30 KW, 60 Hz generator sets. Army Mobility Equipment Command, St. Louis, Mo. DA–AK01–67–C–1425.

—**Barrett Intercommunication Products Corp.**, Brooklyn, N.Y. $2,448,997. TA–312/PT telephone sets. Procurement Div., Army Electronics Command, Philadelphia, Pa. DA–AB05–70–C–4104.

—**Philco-Ford Corp.**, Palo Alto, Calif. $13,000,000. Classified electronics equipment. Palo Alto and Scotsdale, Ariz. Army Electronics Command, Fort Monmouth, N.J.

3—**Global Associates**, Oakland, Calif. $1,528-125 (contract modification). Logistics support of the Kwajalein Missile Range, Marshall Islands. Army Safeguard System Command, Huntsville, Ala. DA–HC60–70–C–0001.

—**AVCO Corp.**, Stratford, Conn. $6,695,000. Titanium rotor modification kits for T–53 turbine engines. Charleston, S.C. Army Aviation Systems Command, St. Louis, Mo. AF–41–608–69–A2421.

—The following contract modifications for M514A1E1 fuze units were awarded by Harry Diamond Laboratories, Washington, D.C.:

Raytheon Co., Bristol, Tenn. $2,734,740. DA–AG39–70–C–0028.

Fairchild Camera and Instrument Corp., Copiague, N.Y. $1,350,300. DA–AG39–70–C–0027.

4—**Lockheed Aircraft Corp.**, Sunnyvale, Calif. $4,000,000. Design, fabrication, field installation monitoring, check out and operation of the experimental system for the Diamond Sculls underground nuclear test at the Nevada test site. Sunnyvale and Seattle, Wash. Defense Atomic Support Agency, Washington, D.C. DS–SA01–70–C–0077.

—The following contracts were issued by the Army Ammunition Procurement and Supply Agency, Joliet, Ill.:

Chamberlain Manufacturing Corp., Elmhurst, Ill. $9,715,200. Metal parts for 155mm high explosive projectiles, M107. Scranton, Pa. DA–AA09–70–C–0304.

AVCO Economics Systems Corp., Washington, D.C. $2,629,423 (contract modification). Repairing and manufacturing ammunition components and ancillary equipment. Glasgow, Mont. DA–AA13–69–C–0064.

6—**Carter Construction Co., Inc.**, Benton, Ark. $1,184,000. Excavation of an auxiliary navigation channel along Sans Bois Creek, Haskell County, Okla., as part of the Robert S. Kerr Lock and Dam Project. Army Engineer District, Tulsa, Okla. DA–CW56–70–C–0081.

—**Raytheon Co.**, Lexington, Mass. $1,035,522. Metal parts assembly for M905 tail bomb fuzes. Bristol, Tenn. Army Ammunition Procurement and Supply Agency, Joliet, Ill. DA–AA09–70–C–0288.

—**Jahncke Service Corp.**, New Orleans, La. $1,194,100. Maintenance dredging of shoal material from the Mississippi River Gulf outlet channel as part of the Mississippi River Gulf Outlet Project. St. Bernard and Plaquemines parishes, La. Army Engineer District, New Orleans, La. DA–CW29–70–C–0158.

—**ITT Gilfillan**, Van Nuys, Calif. $4,600,000. RATAC radar systems and ET/ST model radar systems, AN/TPS–58. Van

Nuys and Europe. Army Electronics Command, Fort Monmouth, N.J. DA-AB07-70-C-0176.

11—**Action Manufacturing Co.**, Philadelphia, Pa. $1,056,515. Metal parts for M905 bomb tail fuzes. Army Ammunition Procurement and Supply Agency, Joliet, Ill. DA-AA09-70-C-0289.

12—**Raytheon Co.**, Bedford, Mass. $9,950,000 (contract modification). Advanced development of the SAM-D missile system. Bedford, Orlando, Fla., White Sands Missile Range, N.M., and Wayland, Mass. Army Missile Command, Huntsville, Ala. DA-AH01-67-C-1995.

13—**Chrysler Motor Corp.**, Warren, Mich. $1,953,912. Stake trucks. Army Tank Automotive Command, Warren, Mich. DA-AE07-70-C-3244.

16—**Honeywell, Inc.**, North Hopkins, Minn. $1,449,092 (contract modification). Metal parts for point detonating fuzes, M551. New Brighton, Minn. Army Ammunition Procurement and Supply Agency, Joliet, Ill. DA-AA09-70-C-0104.

—**Revere Copper and Brass, Inc.**, Detroit, Mich. $1,021,510. 1,282,820 pounds of 220 alloy for bullet jackets. Frankford Arsenal, Philadelphia, Pa. DA-AA25-70-C-0499.

—**Juett Construction Co.**, Winchester, Ky. $2,077,745. Relocation of 7.8 miles of Highway 701, Rowan County, Ky., for the Cave Run Reservoir Project. Army Engineer District, Louisville, Ky. DA-CW27-70-C-0072.

17—**Communications and Systems, Inc.**, Falls Church, Va. $1,000,000 (contract modification). Classified research and development. Army Electronics Command, Fort Monmouth, N.J.

—**Chamberlain Manufacturing Co.**, Waterloo, Iowa. $1,590,625. Metal parts for high explosive warheads for 2.75 inch rockets, M151. Army Ammunition Procurement and Supply Agency, Joliet, Ill. DA-AA09-70-C-0171.

—**AVCO Corp.**, Stratford, Conn. $1,024,150. Contract kits for T-55 turbine engines for CH-47 helicopters. Army Aviation Systems Command, St. Louis, Mo. AF-41-608-69-A2421.

18—**Duane Smelser Roofing Co.**, Warren, Mich. $1,311,900. Roof replacement on a master control room building modification, and repair of the cathodic protection system, Army Missile Plant, Sterling Heights, Mich. Army Engineer District, Chicago, Ill. DA-CA23-70-C-0043.

—**Marathon Battery Co.**, St. Paul, Minn. $1,520,000. High and low temperature protection testing and engineering samples. Army Electronics Command, Philadelphia, Pa. DA-AB05-70-C-1452.

—The following contracts for metal parts for 81mm mortar fuzes M524A6 were awarded by the Army Ammunition Procurement and Supply Agency, Joliet, Ill.:

KDI Precision Products, Cincinnati, Ohio. $2,922,651. DA-AA09-70-C-0324.

Lear Siegler, Inc., Anaheim, Calif. $2,742,000. DA-AA09-70-C-0325.

Penn Akron Corp., Long Island City, N.Y. $2,104,200. DA-AA09-70-C-0326.

I. D. Precision Component Corp., Jamaica, N.Y. $1,457,400. Gadsden, Ala., and Jamaica. DA-AA09-70-C-0327.

19—**Xerox Corp.**, Pasadena, Calif. $2,199,000. and $2,458,000. Gated night sites for the TOW missile system. Pomona, Calif. Army Mobility Equipment Research and Development Center, Fort Belvoir, Va. DA-AK02-70-C-0347 and DA-AK02-70-C-0346.

20—**Bell Helicopter Co.**, Fort Worth, Tex. $20,000,000 (Air Force funds). UH-1H utility helicopters. Hurst, Tex. Army Aviation Systems Command, St. Louis, Mo. DA-AJ01-70-C-0066.

—**Institute for Defense Analysis**, Arlington, Va. $1,634,125 (contract modification). Research for the Dir., Defense Research and Engineering and for the Advanced Research Projects Agency. Defense Supply Service, Washington, D.C. DA-HC15-67-C-0011.

23—**Western Electric Co.**, New York, N.Y. $6,774,300 (contract modification). Components for the Safeguard Missile Site radar. Burlington, N.C. Army Safeguard System Command, Huntsville, Ala. DA-30-069-AMC-00333(Y).

—**Ingraham Industries, McGraw Edison Div.**, Bristol, Conn. $3,543,284. MTSQ fuzes, M564. Army Ammunition Procurement and Supply Agency, Joliet, Ill. DA-AA09-70-C-0217.

—**International Telephone and Telegraph Corp.**, Nutley, N.J. $1,017,922 (contract modification). Engineering changes to AN/GRC-143 radio sets. Army Electronics Command, Philadelphia, Pa. DA-AB05-68-C-0001.

24—**Valley Construction Co.**, Columbus, Miss. $1,472,383. Construction of a two story underground Civil Defense Federal Regional Emergency Operating Center building, Tbomasville, Ga. Army Engineer District, Savannah, Ga. DA-CA21-70-C-0035.

—**University of Wisconsin**, Madison, Wis. $1,280,000 (contract modification). Basic research on interdisciplinary research in the mathematical sciences. Army Research Office, Durham, N.C. DA-31-124-AROD-00462.

—**Hamilton Watch Co.**, Lancaster, Pa. $3,365,752. MTSQ fuzes, M564. Army Ammunition Procurement and Supply Agency, Joliet, Ill. DA-AA09-70-C-0218.

—**Bell Helicopter Co.**, Amarillo, Tex. $1,914,096. Repair of 48 UH-1 series crash-damaged helicopters. Army Aviation Systems Command, St. Louis, Mo. DA-AJ01-68-C-0056.

—**Chrysler Corp.**, Centerline, Mich. $5,106,011 (contract modification). System engineering management for the M60A1E2 tank program. Army Weapons Command, Rock Island, Ill. DA-AF03-69-C-0087.

25—**General Motors Corp.**, Detroit, Mich. $1,185,581. 8V71-T diesel engines for M109 and M578 combat vehicles. Army Tank Automotive Command, Warren, Mich. DA-AE07-70-C-3234.

—**Magnavox Corp.**, Urbana, Ill. $2,742,061. Light weight airborne radio sets, AN/ARC-131. Procurement Div., Army Electronics Command, Fort Monmouth, N.J. DA-AB07-70-C-0179.

—**Bridgeport Brass Co.**, Bridgeport, Conn. $1,718,366. 2,888,010 pounds of cartridge case cups. Indianapolis, Ind. Frankford Arsenal, Philadelphia, Pa. DA-AA25-70-C-0498.

26—**Great Lakes Dredge and Dock Co.**, Cleveland, Ohio. $1,466,000. Spring maintenance dredging in the Cuyahoga and Old Rivers, Cleveland Harbor Project. Army Engineer District, Buffalo, N.Y. DA-CW49-70-C-0039.

—**Brezina Construction Co., Inc.**, Rapid City, S.D. $2,333,991. Widening and rehabilitation of 2.6 miles of embankment to accommodate a four lane highway, 40 miles south of Minot, N.D. Army Engineer District, Omaha, Neb. DA-CW45-70-C-0068.

—**National Presto Industries, Inc.**, Eau Claire, Wis. $10,212,212 (contract modification). Metal parts for 105mm high explosive projectiles, M1. Army Ammunition Procurement and Supply Agency, Joliet, Ill. DA-AA09-69-C-0028.

—**General Motors Corp.**, Detroit, Mich. $3,096,513 (contract modification). 6V53 diesel engines for M113A1 combat vehicles. Army Tank Automotive Command, Warren, Mich. DA-AE07-70-C-0112.

27—The Army Aviation Systems Command, St. Louis, Mo., issued the following contracts:

Chandler Evans, Inc., West Hartford, Conn. $1,136,520. Conversion of fuel controls for UH-1 helicopter engines. DA-AJ01-70-D-0088.

The Boeing Co., Philadelphia, Pa. $3,493,188. Modification kits, transmissions, servocylinders, shipping and storage containers and inspection kits for support of CH-47 helicopters. Morton, Pa. DA-AJ01-68-A-0005.

—**Southwest Truck Body Co., Inc.**, St. Louis, Mo. $1,227,630. 6-ton, two wheel semitrailer vans, M373A2. West Plains, Mo. Army Tank Automotive Command, Warren, Mich. DA-AE07-70-C-03341.

—The Army Ammunition Procurement and Supply Agency, Joliet, Ill., issued the following contracts:

Hercules, Inc., Wilmington, Del. $4,052,141 (contract modification). Operation of propellant production facilities, Army Ammunition Plant, Radford, Va. DA-11-173-AMC-00037(A).

Uniroyal, Inc., New York, N.Y. $3,743,735 (contract modification). Production of explosives, loading, assembling and packing 105mm cartridges, and operation of the Army Ammunition Plant, Joliet, Ill. DA-11-173-AMC-00062(A).

Olin Corp., Stamford, Conn. $1,851,606 (contract modification). Operation of propellant production facilities, Badger Army Ammunition Plant, Baraboo, Wis. DA-AA09-69-C-0014.

Airport Machining Corp., Martin, Tenn. $1,733,400. Metal parts for 2.75 inch rocket warheads, M151. Union City, Tenn. DA-AA09-70-C-0170.

Eureka Williams Co., Bloomington, Ill. $1,542,060. Metal parts for bomb fuzes, M904E2. DA-AA09-70-C-0329.

30—**American Air Filter Co., Inc.**, St. Louis, Mo. $2,442,980. 211 fire trucks and fire fighting equipment sets. Army Mobility Equipment Command, St. Louis, Mo. DA-AK01-70-C-6299.

—**Pettibone Corp.**, Rome, N.Y. $2,600,341. 163 truck cranes of 10,000-pound capacity. Army Mobility Equipment Command, St. Louis, Mo. DA-AK01-70-C-6282.

—**Gulf and Western Industries, Inc.**, Waukesha, Wis. $5,567,400. 20mm cartridge cases, M103. Frankford Arsenal, Philadelphia, Pa. DA-AA25-70-C-0495.

—**Martin-Zachry Constructors**, Honolulu, Hawaii. $1,256,778. Preparation for construction of a remote launch site facility, Illeginni Island, Kwajalein Atoll, Marshall Islands. Army Engineer District, Honolulu, Hawaii. DA-CA83-70-C-0014.

31—The Army Ammunition Procurement and Supply Agency, Joliet, Ill., awarded the following contracts:

Thiokol Chemical Corp., Bristol, Pa. $8,404,782 (contract modification). Loading, assembling and packing projectiles and illuminating signals, Longhorn Army Ammunition Plant, Marshall, Tex. DA-11-173-AMC-00200.

Mason and Hanger, Silas Mason Co., Inc., New York, N.Y. $3,690,207 (contract modification). Loading, assembling and packing bombs and projectiles, and operation of the Cornbuskers Army Ammunition Plant, Grand Island, Neb. DA-AA09-68-C-0383. $14,984,859 (contract modification). Loading, assembling and packing projectiles and components, Army Ammunition Plant, Burlington, Iowa. DA-AA09-68-C-0468.

Olin Corp., Stamford, Conn. $11,656,225 (contract modification). Propellants and ammunition components, and operation of the Army Ammunition Plant, Charlestown, Ind. DA-AA09-69-C-0148.

Firestone Tire and Rubber Co., Ravenna, Obio. $2,208,505 (contract modification). Loading, assembling and packing of projectiles and components, and operation of the Army Ammunition Plant, Ravenna. DA-AA09-70-C-0002.

—**Zurn Engineers**, Upland, Calif. $3,845,000. Construction of the water supply system for the Grand Forks, N.D., Safeguard site. Walsh, Pembina and Cavalier Counties, N.D. Army Engineer District, Omaha, Nebr. DA-CA45-70-C-0057.

—**Keane Construction Co., Inc.**, Paramus, N.J. $1,250,000. Officer's open mess, McGuire AFB, N.J. Army Engineer District, New York, N.Y. DA-CA51-70-C-0056.

—**Olin Corp.**, Stamford, Conn. $2,822,400. Loading, assembling and packing 20mm cartridges, M56A3. LaPorte, Ind. Frankford Arsenal, Philadelphia, Pa. DA-AA25-70-C-0529.

—**Copperweld Steel Co.**, Glassport, Pa. $8,380,800. 1,080,000 squares (100 sq. ft.) of noncorrosive copper-coated steel wire reinforcing fabric for river bank revetment work. Army Engineer District, Memphis, Tenn. DA-CW66-70-C-0091.

—**Ben Construction Co.**, Pittsburgh, Pa. $5,765,778. Widening, deepening, and straightening 2½ miles of Charteir's Creek, Carnegie-Bridgeville section, Pittsburgh. Army Engineer District, Pittsburgh, Pa. DA-CW59-70-C-0159.

—**Guy H. James Construction Co.**, Oklahoma City, Okla. $8,486,150. Work at the Brookville Reservoir, east fork of the White Water River, Ind. Army Engineer District, Louisville, Ky. DA-CW27-70-C-0079.

—The Army Aviation Systems Command, St. Louis, Mo. awarded the following contracts:

General Motors Corp., Indianapolis, Ind. $1,657,677. Product improvement program for the T–63 turbine engine. DA–AJ01–70–C–0528.

The Boeing Co., Philadelphia, Pa. $46,287,544. CH–47 helicopters. Ridley Park, Pa. DA–AJ01–70–C–0505.

Bell Helicopter Co., Fort Worth, Tex. $7,364,644. UH–1N helicopters. Hurst, Tex. DA–AJ01–69–C–0085.

—**Teledyne Industries**, Muskegon, Mich. $4,176,177. Model AVDS–1790–2A engine assemblies for M60 and M48 tanks. Army Tank Automotive Command, Warren, Mich. DA–AE07–70–C–3247.

—**Morrison Knudson Co., Inc., Peter Kiewit Sons Co., Fishbach and Moore,** and **C.H. Leavell and Co.,** Boise, Idaho. $137,858,850. Safeguard defense system technical facilities (missile site radar and perimeter acquisition radar sites). Cavalier and Pembine Counties, N.D. Army Engineer Division, Huntsville, Ala. DA–CA87–70–C–0013.

—**Aluminum Co. of America**, Pittsburgh, Pa. $2,980,744. 104 bridge erection boats. New Kensington, Pa. Army Mobility Equipment Command, St. Louis, Mo., DA–AK01–70–C–6289.

DEPARTMENT OF THE NAVY

2—**Collins Radio Co.**, Richardson, Tex. $1,190,439. Spare parts to support master radio stations serving Coast Guard vessels. Naval Aviation Supply Office, Philadelphia, Pa. N00383–68–A–1300–0774.

—**Quality Motels Construction Corp.,** and **Quality Courts Motels, Inc.,** Silver Spring, Md. $2,098,500. Construction of temporary lodgings facility, Naval Complex, Norfolk, Va. Naval Facilities Engineering Command, Washington, D.C. N62470–70–C–0956.

3—**Alaska-Puget-United Transportation Co.,** San Francisco, Calif. $18,120,000. Supply of defense and Federal Government sites in Alaska for a 5 year period, beginning May 1970. Military Sea Transportation Service, Brooklyn, N.Y.

4—**Texas Instruments, Inc.,** Dallas, Tex. $1,898,485. Design, develop and fabricate a fully integrated guidance control group for the Bulldog missile system, and provide related services for models. Naval Purchasing Office, Los Angeles, Calif. N00123–70–C–0671.

5—**American Construction Co.,** Washington, D.C. $1,491,885. Construction of a hypervelocity wind tunnel building at the Naval Ordnance Laboratory, White Oak, Md. Naval Engineering Facilities Command, Washington, D.C. N62477–68–C–0086.

—The Naval Air Systems Command, Washington, D.C., issued the following contracts:

Raytheon Co., Lexington, Mass. $17,900,400 (contract modification). Guidance and control groups for Sparrow missiles for the Navy and Air Force. Lowell and Bedford, Mass., Bristol, Tenn., and Oxnard, Calif. N00019–69–C–0358. $5,900,013. Guidance and control groups for Sidewinder IC missiles. Lowell, Mass. N00019–70–C–0299.

McDonnell Douglas Corp., Long Beach, Calif. $2,300,000 (contract modification). Increased long lead time funding to support FY 1970 procurement of TA–4J and A–4M aircraft. N00019–67–C–0170.

United Aircraft Corp., East Hartford, Conn. $4,160,760. Fabrication of YTF–30–P–412 engines and conversion of TF–30–P–12 engines to the YTF–30–P–412 version. N00019–69–C–0614.

Sanders Associates, Inc., Nashua, N.H. $4,034,616. AN/SSQ–53 sonobuoys. N00019–70–C–0432.

6—**General Electric Co.,** Schenectady, N.Y. $10,000,000. Design and furnishing of nuclear propulsion components. Naval Ship Systems Command, Washington, D.C. N00024–67–C–5321.

9—**Fairchild Camera and Instrument Corp.,** Copiague, N.Y. $2,142,000. Electric bomb fuzes. Atglen, Pa., and Copiague. Naval Air Systems Command, Washington, D.C. N00019–70–C–0441.

—**Francisco Levy, Hijo, Inc.,** San Juan, P.R. $7,265,000. Construction of a hospital and corpsman barracks, Naval Station, Roosevelt Roads, P.R. Naval Facilities Engineering, Washington, D.C. N62475–70–C–0024.

—**Singer-General Precision, Inc.,** Little Falls, N.J. $1,040,000. Spare parts for intertial measurement systems for A–7D and –7E aircraft. Naval Aviation Supply Office, Philadelphia, Pa. N00383–68–A–3201–0265.

—**Bendix Corp.,** North Hollywood, Calif. $1,526,000. Production support and redesign of component parts for the Mk 46 torpedo control and guidance system. Naval Purchasing Office, Los Angeles, Calif. N00123–70–C–0763.

—The Naval Ship Systems Command, Washington, D.C., issued the following contracts for the design, construction and testing of a full scale mockup model of the amphibious assault landing craft (AALC):

Bell Aerospace Co., Buffalo, N.Y. $1,950,000. Wheatfield, N.Y. N00024–70–C–0267.

Aerojet-General Corp., El Monte, Calif. $1,262,369. N00024–70–C–0268.

—The Naval Ordnance Systems Command, Washington, D.C., issued the following contracts:

Westinghouse Electric Corp., Baltimore, Md. $8,000,000. Long lead time material for Mk 48 Mod 0 torpedoes. Landsdowne, Md. N00017–70–C–1211.

Clevite Corp., Cleveland, Ohio. $17,071,317. Fabricate and produce preproduction prototype Mk 48 Mod 1 torpedoes. N00017–69–C–1426.

10—**General Dynamics Corp.,** Pomona, Calif. $4,704,699 (contract modification). Additional funds for the Standard ARM (AGM–78) missile program for the Air Force. Naval Air Systems Command, Washington, D.C. N00019–69–C–0336.

11—**Piedra Corp.,** Wichita Falls, Tex. $1,600,899. Construction of family housing, Naval Air Station, Beeville, Tex. Naval Facilities Engineering Command, Washington, D.C. N62468–70–C–0008.

—**Sperry Rand Corp.,** Syosset, N.Y. $1,346,150. Poseidon navigation trainer conversion. Naval Strategic Systems Project Office, Washington, D.C. N00030–70–C–0061.

12—**Sperry Rand Corp.,** Charlottesville, Va. $1,402,779. Radar sets, repair parts and engineering services. Naval Ship Systems Command, Washington, D.C. N00024–70–C–1212.

13—The Naval Air Systems Command, Washington, D.C., issued the following contracts:

VAST, Inc., Waterford, Conn. $1,836,455. Engineering testing, preproduction sample testing, and producton lot sample testing for quality control of sonobuoys, bathythermograph transmitter sets and underwater sound signals. South Bristol, Maine, and St. Croix, V.I. N00019–70–C–0341.

Hughes Aircraft Co., Culver City, Calif. $6,450,000 (contract modification). Installment funding for the Phoenix missile program for FY 1970. N00019–67–C–0240.

Lockheed Aircraft Corp., Burbank, Calif. $5,599,213 (contract modification). Increase long lead time funding for FY 1970 P–3C aircraft. N00019–69–C–0237.

16—**Honeywell, Inc.,** St. Petersburg, Fla. $4,343,244. Poseidon inertial guidance components. Naval Strategic Systems Project Office, Washington, D.C. N00030–70–C–0064.

17—**General Dynamics Corp.,** Pomona, Calif. $3,505,000 (contract modification). Long lead time items for Standard ARM missiles. Naval Ordnance Systems Command, Washington, D.C. N00017–67–C–2107.

19—**General Electric Co.,** Pittsfield, Mass. $7,787,472. Guidance system assemblies for Poseidon missiles. Naval Strategic Systems Project Office, Washington, D.C. N00030–70–C–0121.

—**United Aircraft Corp.,** East Hartford, Conn. $1,144,608. Spare parts for YTF–30–P–412 engines for the F–14A. Naval Aviation Supply Office, Philadelphia, Pa. N000383–0–69000A–AH100.

—**Data Products Corp.,** Woodland Hills, Calif. $1,476,483. High speed data line printers. Naval Ship Systems Command, Washington, D.C. N00024–70–C–1203.

23—**Hughes Aircraft Co.,** Culver City, Calif. $7,835,947. Flight test program for the AIM–54A Phoenix missile. Naval Air Systems Command, Washington, D.C. N00019–70–C–0346.

—**Western Electric Co.,** New York, N.Y. $5,114,422. Cable-laying equipment. Naval Electronic Systems Command, Washington, D.C. N00039–70–C–3529.

—**General Dynamics Corp.,** Pomona, Calif. $4,375,800. Engineering services to investigate missile performance during fleet firing support of the Terrier, Tartar and Standard missile systems integrated logistics support program. Naval Ordnance Systems Command, Washington, D.C. N00017–70–C–2207.

—**Bell Helicopter Co.,** Hurst, Tex. $1,843,976. Rotor blades, drive mechanisms and components for UH–1N helicopters. Naval Aviation Supply Office, Philadelphia, Pa. DA–AJ01–69–A–0314GBCG.

—**Oshkosh Motor Truck Inc.,** Oshkosh, Wis. $1,543,455. 27 aircraft crash fire fighting and rescue trucks. Naval Facilities Engineering Command, Washington, D.C. N62465–70–C–0324.

—**Sperry Rand Corp., St. Paul,** Minn. $1,098,420. Computer components and associated spare parts. Naval Ship Systems Command, Washington, D.C. N00024–70–C–1221.

24—**Honeywell, Inc.,** Minneapolis, Minn. $12,055,477 (contract modification). Second half FY 1970 procurement of Rockeye II weapons system components. Naval Air Systems Command, Washington, D.C. N00019–70–C–0140.

—**Texas Instruments, Inc.,** Dallas, Tex. $3,000,000. Design, development and fabrication of AN/APS–116 radar sets for S–3A aircraft. Naval Air Systems Command, Washington, D.C. N00019–70–C–0398.

25—The Naval Ship Systems Command, Washington, D.C., issued the following contracts:

General Electric Co., Schenectady, N.Y. $6,834,000. Designing and furnishing nuclear propulsion components. N00024–70–C–5388. $2,000,000 (contract modification). Nuclear propulsion research and development. N00024–70–C–5027.

North American Rockwell Corp., Anaheim, Calif. $1,300,000. Refurbishment and modification of Ships Inertial Navigation Systems (SINS). N00024–70–C–5419.

—**Construcciones Werl, Inc.,** Bayamon, P.R. $1,323,338. Sewage treatment plants, Naval Station, Roosevelt Roads, P.R. Naval Facilities Engineering Command, Washington, D.C. N62475–70–C–0006.

—**Fuller-American,** San Diego, Calif. $2,354,400. Construction of a base brig, Chappo Area, Camp Pendleton Marine Base, Calif. Naval Facilities Engineering Command, Washington, D.C. N62473–70–C–0030.

26—**FMC Corp.,** Minneapolis, Minn. $8,900,000. Design, development and prototype production of the Mk 26, Mods 0, 1 and 2, missile launching system. Naval Ordnance Systems Command, Washington, D.C. N00017–68–C–2109.

—**General Electric Co.,** Pittsfield, Mass. $14,568,890. Fire control and guidance support equipment (phase IIIB) for Poseidon missiles. Naval Strategic Systems Project Office, Washington, D.C. N00030–69–C–0125.

—**Honeywell, Inc.,** Hopkins, Minn. $2,368,280. Mk 46 Mod 1 torpedoes and ancillary parts. Naval Ordnance Systems Command, Washington, D.C. N00017–69–C–1307.

—**Aerojet-General Corp.,** Sacramento, Calif. $2,632,796. Sparrow missile rocket motors for the Navy and Air Force. Naval Air Systems Command, Washington, D.C. N00019-70-C-1229.

—**Philco-Ford Corp.**, Philadelphia, Pa. $2,433,684. 12 shipboard computer displays. Naval Ship Systems Command, Washington, D.C. N00024-70-C-1229.

—**Kollsman Instrument Corp.**, Elmhurst, N.Y. $1,148,936. Mk 90 Mod 1 and Mk 91 Mod 0 proximity fuzes. Naval Ships Parts Control Center, Mechanicsburg, Pa. N00104-70-C-A083.

27—**ITT Gilfillan Corp.** Van Nuys, Calif. $17,592,000. AN/SPS-48(V) radar sets. Naval Ship Systems Command, Washington, D.C. N00024-70-C-1200.

—**The Boeing Co.**, Seattle, Wash. $1,351,817. Special research and development trials of two hydrofoil vessels, PCH-1 and AGEH-1. Naval Purchasing Office, Washington, D.C. N00600-69-C-0618.

30—**Hughes Aircraft Co.**, Culver City, Calif. $13,075,992. Electronic assemblies for the Poseidon guidance system. El Segundo, Calif. Naval Strategic Systems Project Office, Washington, D.C. N00030-70-C-0056.

31—**North American Rockwell Corp.**, Columbus, Ohio. $5,603,600. OV-10B aircraft. Naval Air Systems Command, Washington, D.C. N00019-69-C-0696.

—**Singer-General Precision**, Binghampton, N.Y. $4,515,500. F-4E weapon system training sets (A/F 37U-T9), and installation at field sites. Binghampton and Sunnyvale, Calif. Naval Training Device Center, Orlando, Fla. N61339-70-C-0125.

—**Bell Helicopter Co.**, Hurst, Tex. $1,189,977. AH-1J helicopter rotor blades, drive mechanisms and components. Naval Aviation Supply Office, Philadelphia, Pa. DA-AJ01-69-A-0314-GBCZ.

—**RF Communications, Inc.**, Rochester, N.Y. $1,827,017. AN/URC-58(V) transceivers. Naval Electronic Systems Command, Washington, D.C. N00039-70-C-0534.

DEPARTMENT OF THE AIR FORCE

2—**Thiokol Chemical Corp.**, Brigham City, Utah. $1,379,078. Basic rocket motors and related data for the Genie rocket. Ogden Air Materiel Area, AFLC, Hill AFB, Utah. F42600-70-C-0926.

3—**Davies Supply and Manufacturing Co.**, St. Louis, Mo. $3,067,575. Furnishing and installing equipment for an electroplating process facility, Oklahoma City, Okla. Oklahoma City Air Materiel Area, AFLC, Tinker AFB, Okla. F34601-70-C-2479.

—**North American Rockwell Corp.**, Anaheim, Calif. $1,575,000. Spare parts in support of the Minuteman III weapon system. Ogden Air Materiel Area, AFLC, Hill AFB, Utah. F04701-68-C-0280.

—The Aeronautical Systems Division, AFSC, Wright-Patterson AFB, Ohio, issued the following contracts:

General Electric Co., West Lynn, Mass. $1,379,646. Production of J-85 turbojet engines. F33657-69-C-0008. $1,119,648. Production of J-85 turbojets and related spare parts. F33657-70-C-0229.

General Motors Corp., Indianapolis, Ind. $10,591,190. Production of T-41-A-1 and A-2 turbofan engines. F33657-67-C-0163.

Philco-Ford Corp., Newport Beach, Calif. $1,313,942. Aerospace ground equipment for airborne radar equipment. F33657-70-C-0345.

4—**United Aircraft Corp.**, Stratford, Conn. $4,737,632. Components parts for helicopters. Warner Robins Air Materiel Area, AFLC, Robins AFB, Ga. F09603-70-C-2087.

9—**Lockheed Aircraft Corp.**, Marietta, Ga. $3,325,888. Spare parts for C-5A aircraft. San Antonio Air Materiel Area, AFLC, Kelly AFB, Tex. AF33(657)15053. $35,756,000. C-130E aircraft, spare parts and aerospace ground equipment. Aeronautical Systems Division, AFSC, Wright-Patterson AFB, Ohio. F33657-70-C-0481.

10—**Lear Siegler, Inc.**, Grand Rapids, Mich. $4,300,000. Modification of the navigation system of F-4D aircraft. Aeronautical Systems Division, AFSC, Wright-Patterson AFB, Ohio. F33657-70-C-0877.

11—The Aeronautical Systems Division, AFSC, Wright-Patterson AFB, Ohio, issued the following contracts:

General Electric Co., West Lynn, Mass. $2,780,356. Production of T-64-GE-413 turboshaft engines. F33657-69-C-1214.

General Electric Co., Cincinnati, Ohio. $3,000,000. Development of an advanced turbine engine gas generator. Evendale, Ohio. F33657-70-C-0340. $5,000,000. Engineering effort and services applicable to the TF-39 engine. Evendale, Ohio. F33657-70-C-0531.

—The Electronic Systems Division, AFSC, L.G. Hanscom Field, Mass., issued the following contracts:

Westinghouse Electric Corp., Baltimore Md. $5,950,000. Design, manufacture, test and delivery of tactical air defense system with spares and support equipment. F19628-70-C-0119.

Raytheon Co., Burlington, Mass. $3,900,000. Operation and maintenance of communication sites. F19628-70-C-0021.

—The following contracts were awarded by the Ogden Air Materiel Area, AFLC, Hill AFB, Utah:

Superior Steel Ball Co., New Britain, Conn. $1,533,000. Component parts for anti-personnel bombs. Washington, Ind. F42600-70-C-0655.

AiResearch Manufacturing Co., Los Angeles, Calif. $1,738,428. Modification and repair of central air data computer components applicable to the RF-4 series aircraft. Torrance, Calif. F04606-69-A-0207.

12—**M-B** Associates, San Ramon, Calif. $1,024,000. Auxiliary penetration aid. Space and Missile Systems Organization, AFSC, Los Angeles, Calif. F04606-69-A-0239.

—The Aeronautical Systems Division, AFSC, Wright-Patterson AFB, Ohio, issued the following contracts:

LTV Electrosystems, Inc., Dallas, Tex. $1,533,885. Communications equipment. F33657-70-C-0325.

Lockheed Aircraft Corp., Marietta, Ga. $50,000,000. C-5A aircraft. AF33(658)-15053.

13—**Hayes International Corp.**, Birmingham, Ala. $2,251,283. Inspection and repair, as necessary, maintenance and modification of C-130 aircraft. Warner Robins Air Materiel Area, AFLC, Robins AFB, Ga. F09603-70-C-0793.

—**General Dynamics Corp.**, Fort Worth, Tex. $6,746,705. Spare parts for F-111 aircraft. Sacramento Air Materiel Area, AFLC, McClellan AFB, Calif. AF33(657)13403.

—**Singer-General Precision, Inc.**, Binghamton, N.Y. $2,379,397 (contract modification). F-111 mission simulators. Aeronautical Systems Division, AFSC, Wright-Patterson AFB, Ohio. AF33657-15427.

—The San Antonio Air Materiel Area, AFLC, Kelly AFB, Tex., issued the following contracts:

Kollsman Instrument Corp., Elmhurst, N.Y. $1,140,481. Pressure temperature test sets. F41608-69-D-9020.

AiResearch Manufacturing Co., Phoenix, Ariz. $4,525,562. Gas turbine engines. F41608-70-D-1401.

16—**United States Underseas Cable Corp.**, Washington, D.C. $5,296,861. Engineering, furnishing and installing a submarine cable system in the Pacific. Simplex Wire and Cable Co., Newington, N.H. Oklahoma City Air Materiel Area, AFLC, Tinker AFB, Okla.

17—**North American Rockwell Corp.**, Canoga Park, Calif. $2,708,416. Thor missile propulsion systems. Space and Missile Systems Organization, AFSC, Los Angeles, Calif. F04701-69-C-0333.

19—**General Electric Co.**, West Lynn, Mass. $2,800,000. T-64 aircraft engine components. Aeronautical Systems Division, AFSC, Wright-Patterson AFB, Ohio. F33657-70-C-0545.

23—**The Boeing Co.**, Seattle, Wash. $2,009,837. Design, development, study and test programs for Minuteman missiles. Space and Missile Systems Organization, AFSC, Los Angeles, Calif. F04701-69-C-0153.

24—**General Dynamics Corp.**, Fort Worth, Tex. $11,730,000. F-111 aircraft. Aeronautical Systems Division, AFSC, Wright-Patterson AFB, Ohio. AF33(657)13403.

25—The Space and Missile Systems Organization, AFSC, Los Angeles, Calif., awarded the following contracts:

McDonnell Douglas Corp., Huntington Beach, Calif. $1,695,000. Launch support services and related tasks supporting Thor booster space programs. Huntington Beach and Vandenburg AFB, Calif. F04701-70-C-0037.

General Motors Corp., Goleta, Calif. $1,799,697. Hypervelocity Range Research Program. F04701-70-C-0118.

AVCO Corp., Greenwich, Conn. $9,225,627. Ballistic missile penetration aids. F04701-68-C-0039.

—**Doehler-Jarvis Div., National Lead Co.**, Toledo, Ohio. $1,151,967. Component parts for munitions. Batavia, N.Y., and Toledo. Ogden Air Materiel Area, AFLC, Hill AFB, Utah. F42600-70-C-0661-P003.

—**General Electric Co.**, West Lynn, Mass. $1,000,000. Component inprovement program for T-58 and J-85 series aircraft engines. Aeronautical Systems Division, AFSC, Wright-Patterson AFB, Ohio. F33657-70-C-0545-P002.

26—**General Electric Co.**, Cincinnati, Ohio. $13,100,000. TF-39 turbofan aircraft engines. Evandale, Ohio. Aeronautical Systems Division, AFSC, Wright-Patterson AFB, Ohio. AF33(657)15003.

27—**Lockheed-Georgia Co.**, Marietta, Ga. $3,974,074. C-5A spare parts. Detachment 31, San Antonio Air Materiel Area, AFLC, Marietta, Ga. AF 33(657)15053.

—**United Aircraft Corp.**, East Hartford, Conn. $2,007,200. Repair kits for TF-30 series aircraft engines. Aeronautical Systems Division, AFSC, Wright-Patterson AFB, Ohio. N383-69000A-SC45.

30—**Hayes International Corp.**, Birmingham, Ala. $1,361,394. Management and operation of the Air Force Publications Distribution Center, Baltimore, Md. Procurement Div., 2750th Air Base Wing, Wright-Patterson AFB, Ohio. F33600-70-C-0242.

—**The Boeing Co.**, Wichita, Kan. $1,162,290. Modification kits for C-135 and KC-135 aircraft. Oklahoma City Air Materiel Area, AFLC, Tinker AFB, Okla. F34601-69-A-0419.

—The Aeronautical Systems Division, AFSC, Wright-Patterson AFB, Ohio, awarded the following contracts:

General Dynamics Corp., Fort Worth, Tex. $51,081,576. F-111 aircraft. AF33(657)-13403.

Bendix Corp., Teterboro, N.J. $2,880,000. Computers for F-105 and F-106 aircraft. F33657-70-C-0880.

31—**Lear Siegler, Inc.**, Grand Rapids, Mich. $1,541,556. AN/AJB-7 computer components applicable to aircraft bombing systems. Aeronautical Systems Division, AFSC, Wright-Patterson AFB, Ohio. F33657-70-C-0192.

—**International Telephone and Telegraph Corp.**, Nutley, N.J. $1,905,000. QRC-510 electronic countermeasure equipment. Aeronautical Systems Division, AFSC, Wright-Patterson AFB, Ohio. F33657-70-C-0816.

—The Space and Missile Systems Organization, AFSC, Los Angeles, Calif., awarded the following contracts:

The Boeing Co., Seattle, Wash. $1,276,600. Installation and test support for the hard rock silo development program. F04701-69-C-0186.

Philco-Ford Corp., Palo Alto, Calif. $4,500,000. Operation and maintenance of Air Force Satellite Control Facility tracking stations, New Boston, N.H. F04701-70-C-0114.

Lockheed Aircraft Corp., Sunnyvale, Calif. $4,300,000. Operation of AF Satellite Control Facility tracking stations. F04701-70-C-0013. $3,078,000. Operation and maintenance of AF Satellite Control Facility tracking stations. Alaska and Hawaii. F04701-70-C-0012.

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Air Force Gets New Centrifuge

A multi-stress device, called a dynamic environment simulator (DES), has been placed into operation by the Air Force at the Aerospace Medical Research Laboratory, Wright-Patterson AFB, Ohio. It was designed for the laboratory by The Franklin Institute Research Laboratories, Philadelphia, Pa.

The large, sophisticated centrifuge has a rotating mass of 180 tons and was designed to determine tolerance limits of the human body to a variety of environmental conditions that exist in high speed aircraft and in space flight.

Among the flight effects which the DES duplicates are acceleration and deceleration of different intensities, with onset over varying periods, in any direction through the body, tossing, tumbling, buffeting, and other random motions; and vibrations of the type produced by various rocket launching systems. These motions may be coupled with diverse degrees of atmospheric pressure, temperature, and humidity inside the cabin, to measure the total amount of stress induced by the flight environment.

The DES consists of three basic rotating parts: the arm which can reach 56 revolutions per minute and 20 gs; the fork gondola which reaches 30 rpm; and the cab which reaches 150 rpm.

Military Construction Request for FY 1971 Totals $2.069 Billion

The Defense Department has submitted to Congress a Military Construction Authorization Bill for FY 1971 totaling $2,069,094,000. The bill includes authorizations in support of the military services, the defense agencies and the reserve components.

Projects included in the authorization request are located at 260 named military installations in the United States, the Caribbean, Europe, Pacific Islands, Japan and Korea.

Also included in the total request is $809,038,000 for military family housing. New construction of family housing units accounts for $196,507,000 of this total, for 8,000 units in the United States and overseas. The balance represents maintenance and operation, improvements to existing quarters, leasing costs, and payments of principal and interest on mortgage obligations.

Major elements of the authorization request are contained in table below.

Proposed Military Construction Authorization for FY 1971

	U.S. Locations	Overseas Locations	Not Specified	Total
Army	$ 514,877,000	$112,578,000	$ —	$ 627,455,000
Navy	258,469,000	25,752,000	—	284,221,000
Air Force	223,422,000	43,858,000	—	267,280,000
Reserve Components	37,500,000	—	—	37,500,000
Defense Agencies	8,600,000	—	35,000,000	43,600,000
Subtotal	$1,042,868,000	$182,188,000	$35,000,000	$1,260,056,000
Military Family Housing	—	—	—	809,038,000
Total	$1,042,868,000	$182,188,000	$35,000,000	$2,069,094,000

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AFCS and GEEIA Join, Move to New Headquarters

The Air Force has announced the restructuring and relocation of the Air Force Communications Service (AFSC), Scott AFB, Ill., and its consolidation with the Ground Electronics Engineering Installation Agency (GEEIA), Griffis AFB, Rome, N.Y. The command will retain the AFCS designation and will be headquartered at Richards-Gebaur AFB, Mo.

The merger will give the Air Force a single manager concept for communications-electronics, capable of performing engineering, installation, operation and maintenance. Consolidation is expected to produce a savings of $14 million annually, with manpower reductions of 2,100 persons.

The action includes reorganization of intermediate headquarters, and collocation and union of AFCS and GEEIA units throughout the world.

Eliminated in the consolidation are the six geographical divisions of the continental United States by AFCS and GEEIA. In their place are two new regions: the Northern Area, with headquarters at Griffis AFB, N.Y.; and the Southern Area, with headquarters at Oklahoma AFS, near Tinker AFB, Okla.

GEEIA's Pacific Region will be consolidated with AFCS's Pacific Communications Area, with headquarters at Wheeler AFB, Hawaii.

Activation of a special headquarters detachment at Richards-Gebaur AFB on March 15 marked the beginning of the relocation-consolidation process, which is expected to be completed by September 30. AFCS will assume command of the base on July 1.

Fireproof Flight Suits Tested

Air Force pilots may have a fireproof replacement for cotton flight suits in the near future, because of a fiber called polybenzimidazole (PBI).

In comparison tests under conditions of jet fuel fires, with temperatures from 1,800 to 2,200 degrees F., PBI showed less than 10-percent body area burned, with only slight charring and no ignition. Cotton suits showed greater than 60 percent body area burned and non-melting nylon greater than 35 percent.

Of the three materials, only PBI provided protection against blistering for more than three seconds.

Wear tests of PBI cloth will be conducted this summer with the procurement of suits by the Life Support System Program Office, Aeronautical System Division, AFSC, Wright-Patterson AFB, Ohio.